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Characteristics of Selected Upland Soils of the Georgia Coastal Plain

Abstract

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A study was conducted to characterize morphological, physical, chemical, and mineralogical properties of the Dothan, Fuquay, and Tifton soil series as found on the Little River Watershed of the Tifton Upland physiographic province. Two sites were selected for each of the soil series, one agricultural site and one forested site. Detailed morphological descriptions were made of the soils at each site. Physical analyses of soil samples included particle-size distribution, bulk density, soil moisture retention, saturated hydraulic conductivity, liquid limit, and plasticity index. Chemical properties determined on soil samples included measurements of bases, acidity, extractable Al, CEC, pH, conductivity, organic carbon, total nitrogen, extractable Fe and Al, and total analyses of K_2O and Fe. Analyses of mineralogical properties included surface area and the components of the very fine sand and clay fractions.

All the sites contained a sandy epipedon underlain by B and C horizons much higher in clay. The properties of each soil were dominated by the relative proportions of sand and clay. Saturated hydraulic conductivities were higher in the epipedons and lower in the dense higher clay B and C horizons. Soil moisture retention was lower in the sandy epipedons and higher in the B and C horizons. Bulk densities reflected both the pedogenic processes which result in plinthite in the lower part of the argillic horizon in these soils, and compaction in the upper part of the pedon at the agricultural sites. Such mineralogical properties as surface area largely reflected clay content. The main difference in properties between the forested and agricultural sites was in saturated hydraulic conductivity of the A horizons, which was much higher at the forested sites. Other differences between forested and agricultural sites of the same soil series were minor and were primarily a reflection of differences in the original parent material.

KEYWORDS: plinthic soils, bulk density, soil moisture retention, saturated hydraulic conductivity, electrolytic conductivity, mineralogy

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CHARACTERISTICS OF SELECTED UPLAND SOILS OF THE GEORGIA COASTAL PLAIN

R.K. Hubbard, C.R. Berdanier, H.F. Perkins, and R.A. Leonard[1]

Introduction

The Coastal Plain of Georgia can be described topographically as an area of floodplains, river terraces, and gently sloping uplands. Interstream divides are moderately wide and separate relatively broad valleys (Jensen et al. 1959). Soils in the region can be grouped as upland or lowland, with lowland soils being those immediately adjacent to drainage networks. Land use is primarily agricultural with cropland, forest, and pasture occupying large areas. Swamp hardwood communities occur along stream edges and are often accompanied by thick undergrowth vegetation.

Upland soils of the Georgia Coastal Plain have surface horizons which are primarily sands, loamy sands, or sandy loams. The infiltration rates for these soils generally are in excess of 5 cm/h (Rawls et al. 1976). At depth, however, many of these soils contain horizons which impede downward percolation of water. Plinthic soils of the Georgia Coastal Plain contain such horizons at depths ranging from 75-200 cm below the soil surface (Perkins et al. 1978 and 1979). The combination of sandy surface textures and relatively impermeable subsoils causes up to 79 percent of total runoff to leave the upland landscape as shallow subsurface flow (Hubbard and Sheridan 1983.)

Movement of agricultural chemicals in this landscape is from the upland soils through the riparian zone, into streamflow. As much as 99 percent of NO_3-N moves from uplands with shallow subsurface flow (Hubbard and Sheridan 1983). Evidence has shown that the riparian zone acts as a filter for many agricultural nutrients (Lowrance et al. 1983, Yates and Sheridan 1983). The initial movement of water and nutrients from the upland soils is dependent on the hydrological regime imposed on the ecosystem, agricultural management, and the physical and chemical characteristics of the upland soils. Physical factors of particular importance to surface and subsurface runoff, erosion, and movement of agricultural chemicals include particle-size distribution, soil structure, bulk density, hydraulic conductivity, and soil moisture retention.

This study was made to characterize selected morphological, physical, chemical, and mineralogical properties of the Dothan, Fuquay, and Tifton soil series. These upland plinthic soils occupy significant portions of the Coastal Plain landscape and are important for both crop and forest production. Since certain physical properties (bulk density, hydraulic conductivity) may vary with management system, the study included information from both agricultural and forested sites. The objective of the study was to obtain information on the properties of these soils to enhance efforts to understand and predict water and chemical movement in this landscape and to provide information suitable for predictive modeling efforts. Modeling work needing such information includes recent work by Rawls and Brakensiek (1983) on predicting Green and Ampt infiltration parameters. Their model requires particle-size distribution,

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[1] Respectively, soil scientist, Southeast Watershed Research Laboratory, USDA-ARS, Tifton, GA 31793; soil investigations specialist, USDA-SCS, South National Technical Center, Fort Worth, TX 76115; professor of agronomy, University of Georgia, Athens 30602; and research leader, Southeast Watershed Research Laboratory, USDA-ARS, Tifton.

percent organic matter, and bulk density as input soils information.

Another example of recent research using the type of information gained from this study is phosphorus-modeling efforts by Jones et al. (1984a, 1984b) and Sharpley et al. (1984.) Their work focused on obtaining predictive equations for P relationships in soils using chemical, physical, and taxonomic data for 78 soils from the continental United States and Puerto Rico. As modeling efforts continue to work towards development of equations based on measured chemical and physical properties that can be used for all soils, information such as that gained from this study will become increasingly necessary and important. The information from this study also is useful for those involved in such areas as resource management and irrigation scheduling.

Sampling Sites

Sampling sites for the study were selected on the Little River Watershed (LRW) in Tift and Turner Counties, Georgia. The Little River Watershed, as instrumented by the Southeast Watershed Research Laboratory (SEWRL), USDA-ARS, comprises 334 km^2 with headwaters in Turner County near Ashburn, Georgia, and a terminal streamflow gauging station (station B) in Tift County west of Tifton, Georgia. The sampling sites in Turner County were near the LRW headwaters and were selected as being representative of upper watershed forested sites. The Tift County sites were selected as representative of lower watershed areas that had been in cropland for a number of years. A total of six sampling sites were selected, one forested and one agricultural site each for the Dothan, Fuquay, and Tifton soil series. The sites were excavated by backhoe, and samples were collected for measuring the soil's physical, chemical, and mineralogical properties. Soil pedon descriptions were made at the time of sample collection.

Vegetation at the forested (Turner County) Dothan and Fuquay sites consisted of loblolly pine trees (*Pinus taeda* L.) with an understory of wiregrass (*Aristada stricta*). The pine stands had been planted for commercial use, and stand height indicated that the trees were about 15 years old. The forested Tifton site had long-leaf pine trees (*Pinus palustris* Mill.) with an understory of wiregrass (*Aristada stricta*). Tree height indicated the trees to be 50 to 60 years old. Historical land management on the sites was partially reconstructed from 1937 on using aerial photographs from 1937, 1948, 1962, and 1969. All three sites were open-grazed woodland in 1937 and 1948, being more open in 1948 than 1937. By 1962 the sites were more heavily wooded, but still being used for grazing. The 1969 photo shows the Dothan and Fuquay sites in young pine trees. The aerial photos indicate that the three Turner County forested sites probably never were used as cropland (personal communication, J. Sharpe).

Vegetation at the agricultural sites was bahiagrass (*Paspalum notatum* Flugge). Both the Dothan and Fuquay agricultural sites were located in open pasture which had been cropped previously. The Tifton agricultural site was located adjacent to an abandoned tenant house. The Tifton site probably was used as a rest spot by farmworkers because of large shade trees near the house and, hence, may have had considerable traffic from vehicles or heavy farm machinery.

Soil Pedon Descriptions

The Dothan, Fuquay, and Tifton soil series all contain plinthite. The Fuquay series is classified as an Arenic Plinthic Paleudult, and the Dothan and Tifton series are classified as Plinthic Paleudults. Significant differences between the three soil series exist in the Ap and E horizons. The Fuquay soils have thick surface horizons (Ap and E), with B horizons generally beginning at 65-90 cm depth. In contrast, the surface horizons of Dothan and Tifton soils are not as thick, with B horizons beginning at 20-30 cm. A major difference between the Dothan and Tifton series is the presence of ironstone nodules and quartz pebbles in the Ap and E horizons of the Tifton, which is in agreement with data reported by Perkins et al. (1979).

Differences in horizon designations, textures, structures, and colors were observed between the soils sampled at the forested and agricultural sites (tables 1-3). The forested Dothan was described as having Bw and Bt horizons, while the agricultural Dothan had Bt horizons without a Bw above the argillic horizon. Horizon designations were the same for both Fuquay soils. The two Tifton soils showed considerable difference in horizon designations. The forested Tifton, located among mature pine trees, contained Oi, Ac, and Ec horizons, while the agricultural Tifton had a single Ap horizon. The forested Tifton contained Btc and Bt horizons; whereas, the agricultural Tifton had Bt1 and Bt2 horizons. Also, the forested Tifton contained a B't horizon between the Btv and BC horizons, which was not found in the agricultural Tifton.

Texturally, the forested Dothan contained sandy clay loam in the Btv1 and Btv2 horizons. The agricultural Dothan contained clay at similar depths. Textures by horizons were the same for the Fuquay soils except for the E horizons. The E horizon of the forested Fuquay was sand, while that of the agricultural Fuquay was loamy sand. The Bwc of the forested Tifton was loamy sand, as opposed to sandy loam at the agricultural Tifton, and the Bt and Btv of the forested Tifton were sandy clay, as opposed to sandy clay loam at similar depths in the agricultural Tifton.

Structural differences in the surface horizons related to cropland versus forest management practices. Platy structures in the agricultural Dothan Ap and Tifton Apc reflected traffic from farm machinery. Granular structure in the same horizons was observed at the forested Dothan and Tifton sites. More gravel was found in the forested Tifton than in the agricultural Tifton. Differences in such properties as number of ironstone concretions and soil colors between the forested and agricultural soils relate both to differences in original parent material and to pedogenic processes that have occurred since deposition.

Particle-Size Distribution

Samples collected from the forested and agricultural sites were analyzed for particle-size distribution at the National Soil Survey Laboratory (NSSL) in Lincoln, Nebraska. The pipet method of particle-size analyses was used for the finer fractions, while determinations of sand fractions and separates coarser than 2 mm were made by sieving according to methods 3A1, 3B1 of the Soil Survey Investigations Report (SSIR) No. 1 (Soil Conservation Service 1982).

Table 1
Dothan series: Description of the forested and agricultural sites

The Dothan series consists of deep, well-drained, moderately slowly permeable soils that formed in thick unconsolidated medium to fine-textured sediments of the Coastal Plain. These soils are on broad, nearly level to strongly sloping uplands. Slopes range from 0 to 12%.

Taxonomic Class: Fine-loamy, siliceous, thermic Plinthic Paleudults.

FORESTED SITE

Sampled Pedon: Dothan loamy sand (S81GA-287-003)--on a 3% linear northwest-facing slope in a stand of loblolly pines with an understory of blueberries and blackberries.

Location: About 11 km W-NW of Ashburn, GA, at 31°45'7"N, 83°46'44"W (Turner Co.).

Horizon	Depth (cm)	Description
Ap	0-20	Dark grayish-brown (10YR 4/2) loamy sand; weak fine granular structure; very friable; many roots; strongly acid; abrupt wavy boundary.
Bw	20-38	Brownish-yellow (10YR 6/6) loamy sand; weak fine granular structure; friable; common roots; root holes filled with Ap material; very strongly acid; clear wavy boundary.
Bt	38-76	Yellowish-brown (10YR 5/6) sandy clay loam; weak medium subangular blocky structure; few clay films on ped faces; firm; few roots; strongly acid; clear wavy boundary.
Btv1	76-129	Yellowish-brown (10YR 5/6) sandy clay loam; common medium distinct yellowish-red (5YR 5/8) and strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; few clay films on ped faces; firm; 8% plinthite, few roots; strongly acid, clear wavy boundary.
Btv2	129-160	Yellowish-brown (10YR 5/6) sandy clay loam; many medium prominent red (2.5YR 4/6), yellowish red (5YR 5/8) and light gray (10YR 7/1) mottles; moderate medium subangular blocky structure; common clay films on ped faces; firm; 12% plinthite; few roots; strongly acid; gradual wavy boundary.

Table 1
Dothan series: Description of the
forested and agricultural sites--Continued

BC	160-184	Yellowish-brown (10YR 5/6) sandy clay loam; many medium prominent red (2.5YR 4/8) and light-gray (10YR 7/1) mottles; weak fine subangular blocky structure; firm; few roots; strongly acid; gradual wavy boundary.
C	184-274	Reticulately mottled yellowish-brown (10YR 5/6), light-gray - gray (10YR 6/1), yellowish-red (5YR 5/8) and red (2.5YR 4/8) sandy clay loam with pockets of sandy loam; massive very strongly acid residuum of the Hawthorn Formation.

AGRICULTURAL SITE

Sampled Pedon: Dothan loamy sand (S81GA-277-003) - on a 3% convex northeast facing slope with bahiagrass cover.

Location: About 13 km W-NW of Tifton, GA, on the Coastal Plain Experiment Station (Ponder Farm, Tift Co.).

Horizon	Depth (cm)	Description
Ap	0-30	Very dark grayish-brown (10YR 3/2) loamy sand; weak fine granular with some weak medium platy structure; very friable; many roots; very strongly acid; abrupt smooth boundary.
Bt1	30-81	Yellowish-brown (10YR 5/8) sandy clay loam; weak fine subangular blocky structure; few clay films on ped faces; firm; common roots which grow along ped faces; very strongly acid; gradual wavy boundary.
Bt2	81-104	Yellowish-brown (10YR 5/6) clay; few fine distinct yellowish-red (5YR 4/6) mottles; weak fine subangular blocky structure with major partings 15 to 25 cm apart which are filled with illuvial clay; few clay films on ped faces; firm; 2% plinthite; strongly acid; clear wavy boundary.
Btv1	104-125	Yellowish-brown (10YR 5/6) clay; many fine prominent red (2.5YR 4/6) and many fine distinct light yellowish-brown (10YR 6/4) and light-gray (10YR 7/2) mottles; weak fine subangular blocky structure; few clay films on ped faces; firm; 15% plinthite; very strongly acid; clear wavy boundary.

Table 1
Dothan series: Description of the
forested and agricultural sites--Continued

Btv2	125-151	Yellowish-brown (10YR 5/6) sandy clay loam; many fine prominent red (2.5YR 4/6) and many fine distinct light brownish-gray (10YR 6/2) and yellow (10YR 7/6) mottles; weak fine subangular blocky structure; common clay films on ped faces; firm; 12% plinthite (about 50% platy); very strongly acid; clear wavy boundary.
BC	151-180	Yellowish-brown (10YR 5/6) sandy clay loam; many medium prominent dark yellowish-brown (10YR 3/4) and light-gray (10YR 7/1) mottles; weak medium subangular blocky structure; firm; very strongly acid; gradual wavy boundary.

Table 2
Fuquay series: Description of forested and agricultural sites

The Fuquay series consists of well-drained soils that have formed in loamy marine sediments of the upper Coastal Plain. Permeability is moderate in the upper subsoil and slow in the lower part. Slopes range from 0 to 10%.

Taxonomic Class: Loamy, siliceous, thermic Arenic Plinthic Paleudults.

FORESTED SITE

Sampled Pedon: Fuquay loamy sand (S81GA-287-002) on a 2% linear southwest facing slope in a stand of loblolly pine.

Location: About 11 km W-NW of Ashburn, GA, at 31°44'30" N, 83°46'55" W (Turner Co.).

Horizon	Depth (cm)	Description
Ap	0-25	Dark grayish-brown (10YR 4/2) sand; weak fine granular to single grain structure; very friable; 4% ironstone concretions and quartz pebbles; many roots; strongly acid; abrupt smooth boundary.
E	25-65	Yellowish-brown (10YR 5/4) sand; weak fine granular to single grain structure; pockets of washed sand grains; very friable; 4% ironstone concretions and quartz pebbles; common roots; strongly acid; gradual wavy boundary.
Bwc	65-82	Yellowish-brown (10YR 5/6) loamy sand; weak fine granular structure; friable; 10% ironstone concretions; few roots; strongly acid; clear wavy boundary.
Btc	82-136	Strong brown (7.5YR 5/6) sandy clay loam; common fine prominent red (2.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; 3% ironstone concretions and quartz pebbles; 4% plinthite; few roots; strongly acid; gradual wavy boundary.
Btv	136-170	Strong brown (7.5YR 5/6) sandy clay loam; many medium prominent red (2.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few clay films on ped faces; 15% plinthite; strongly acid; clear wavy boundary.

Table 2
Fuquay series: Description of forested and agricultural sites--Continued

BC	170-186	Yellowish-brown (10YR 5/6) sandy clay loam; many medium prominent light-gray (10YR 7/1) and red (10R 4/6) mottles; weak fine subangular blocky structure; firm; strongly acid; abrupt wavy boundary.
C	186-260	Reticulately mottled strong brown (7.5YR 5/8), light-gray (10YR 7/1), reddish-brown (5YR 5/3) and red (10R 4/8) sandy clay loam with pockets of sandy loam; massive; firm; very strongly acid residuum from the Hawthorn Formation.

AGRICULTURAL SITE

Sampled Pedon: Fuquay loamy sand (S81GA-277-002) - on a 3% linear east-facing slope with bahiagrass cover.

Location: About 13 km W-NW of Tifton, GA, on the Coastal Plain Experiment Station (Ponder Farm, Tift Co.).

Horizon	Depth (cm)	Description
Ap	0-33	Dark grayish-brown (10YR 4/2) sand; weak fine granular to single grain structure; very friable; many roots; medium acid; abrupt smooth boundary.
E	33-90	Brownish-yellow (10YR 6/6) loamy sand; weak fine granular to single grain structure; pockets of washed sand grains; very friable; root holes with charcoal and/or Ap material; common roots; strongly acid; clear wavy boundary.
Bwc	90-106	Yellowish-brown (10YR 5/6) loamy sand; weak fine granular structure; very friable; root holes with charcoal and/or Ap material; 4% ironstone concretions and quartz pebbles; common roots; very strongly acid; clear wavy boundary.
Btc	106-128	Strong brown (7.5YR 5/6) sandy clay loam with common medium distinct red (2.5YR 4/6) mottles; weak fine subangular blocky structure; friable; root holes with charcoal and/or Ap material; 10% ironstone concretions and quartz pebbles; 4% plinthite; few to common roots; very strongly acid; clear wavy boundary.

Table 2
Fuquay series: Description of forested and agricultural sites--Continued

Btv	128-156	Strong brown (7.5YR 5/6) sandy clay loam; common medium distinct red (2.5YR 4/6) mottles; weak fine subangular blocky structure; firm; 15% platy plinthite; few roots; very strongly acid; clear wavy boundary.
BC	156-177	Reticulately mottled strong brown (7.5YR 5/6), red (2.5YR 4/6) and light gray (10YR 7/2) sandy clay loam; weak fine subangular blocky structure; firm; very strongly acid; gradual wavy boundary.
C	177-214+	Reticulately mottled strong brown (7.5YR 5/6), red (2.5YR 4/6) and light-gray (10YR 7/2) sandy clay loam; massive; firm; very strongly acid residuum from the Hawthorn Formation.

Table 3
Tifton series: Description of forested and agricultural sites

The Tifton series consists of deep, well-drained, moderately permeable soils that formed in loamy marine sediments. These soils are on smooth upland and have slopes that range from 0 to 8 percent. Mean annual temperature is 21°C, and mean annual precipitation is 1170 mm.

Taxonomic Class: Fine-loamy, siliceous, thermic Plinthic Paleudults.

FORESTED SITE

Sampled Pedon: Tifton loamy sands (S81GA-287-001) - on a 2% convex northwest facing slope in a stand of long-leaf pine.

Location: About 11 km W-NW of Ashburn, GA, at 31°44'19" N, 83°46'12" W (Turner Co.).

Horizon	Depth (cm)	Description
Oi	4-0	Fine needles, oak leaves, and fern fronds underlain with white fungal material.
Ac	0-10	Very dark grayish-brown (10YR 3/2) loamy sand; weak fine granular structure; very friable; 16% ironstone concretions and quartz pebbles; many roots; very strongly acid; abrupt wavy boundary.
Ec	10-31	Brown (10YR 4/3) loamy sand; weak fine granular structure; very friable; 11% ironstone concretions and quartz pebbles; many roots; strongly acid; abrupt wavy boundary.
Bwc	31-38	Yellowish-brown (10YR 5/8) loamy sand; weak fine subangular blocky structure; friable; 12% ironstone concretions and quartz pebbles; many roots; strongly acid; abrupt wavy boundary.
Btc	38-69	Yellowish-brown (10YR 5/6) sandy clay loam; strong medium subangular blocky structure; firm; many clay films on ped faces; 9% ironstone concretions and quartz pebbles; common roots; very strongly acid; clear wavy boundary.
Bt	69-88	Yellowish-brown (10YR 5/6) sandy clay; few medium prominent red (10R 4/6) mottles; moderate medium subangular blocky structure; firm; common clay films on ped faces; 3% plinthite; few roots; very strongly acid; abrupt wavy boundary.

Table 3
Tifton series: Description of forested and agricultural sites--Continued

Btv	88-111	Yellowish-brown (10YR 5/6) sandy clay; common medium prominent red (10R 4/6) and light gray (10YR 6/2) mottles; firm; common clay films on ped faces; 15% plinthite; few roots concentrated in cracks and channels along ped faces; very strongly acid; abrupt wavy boundary.

AGRICULTURAL SITE

Sampled Pedon: Tifton loamy sand (S81GA-277-004) - on a level plain with bahiagrass cover.

Location: About 13 km W-NW of Tifton, GA, on the Coastal Plain Experiment Station (Ponder Farm, Tift Co.).

Horizon	Depth (cm)	Description
Apc	0-29	Dark-brown (10YR 3/2) loamy sand; weak fine granular structure with some weak platy and subangular units when soil in place; very friable; 5% ironstone concretions and quartz pebbles; many plant roots; very strongly acid; abrupt smooth boundary.
Bwc	29-41	Brown (10YR 5/4) sandy loam; weak fine subangular blocky structure with large structural breaks at about 30 cm spacings; friable; 10% ironstone concretions and quartz pebbles; common plant roots; extremely acid; clear wavy boundary.
Bt1	41-78	Yellowish-brown (10YR 5/8) sandy clay loam; moderate fine subangular blocky structure; friable; 3% ironstone concretions and quartz pebbles; few roots primarily concentrated in top of horizon and along structural breaks; very strongly acid; gradual wavy boundary.
Bt2	78-117	Yellowish-brown (10YR 5/8) sandy clay loam; moderate medium subangular blocky structure; common clay films on ped faces; friable; 2% plinthite; few roots along structural breaks; very strongly acid; clear wavy boundary.

Table 3
Tifton series: Description of forested and agricultural sites--Continued

Btv	117-138	Yellowish-brown (10YR 5/8) sandy clay loam; many large prominent red (2.5YR 4/6) and light-gray (10YR 7/2) mottles; weak medium subangular blocky structure; common clay films on ped faces; firm; 10% plinthite; few roots along structural breaks and on ped faces; very strongly acid; clear wavy boundary.
BC	138-183	Reticulately mottled yellowish-brown (10YR 5/8), red (2.5YR 4/6), light-gray (10YR 7/2) and strong brown (7.5YR 5/6) sandy clay; weak medium subangular blocky structure with pockets of massive material; firm, 4% plinthite, extremely acid; gradual wavy boundary.

The percentage of coarse fragments greater than 2 mm varied between sites and horizons, with percentages ranging up to 24 percent (tables 4-6). The highest percentage of coarse fragments in the surface horizon (16%) occurred in the forested Tifton. The agricultural Tifton contained 24 percent coarse fragments in the Bwc horizon at 29-41 cm, rather than in the surface horizon. Differences in location of the coarse fragments between the two soils may relate to tillage effects at the agricultural site. Dothan soils contained relatively little coarse material, having no more than 5 percent in any of the horizons. Significant percentages (up to 24%) of coarse material were found in the the B horizons of both Fuquay soils.

Surface horizons at all locations were primarily sand (tables 4-6). Sand percentages in the A horizons ranged from 74.7 percent in the agricultural Tifton to 90.1 percent in the forested Dothan. Sand percentages decreased in the B horizons as clay concentrations increased. The amount of silt within the profiles remained relatively constant compared with amounts of the other two size fractions.

Differences in particle-size distribution within soil series were observed based on location. Comparisons of the forested and agricultural Dothan soils showed that the forested soil was sandier throughout the pedon. The maximum differences (18%) in percent sand between the two soils occurred in the Bt horizon. Comparisons of the two Tifton soils showed that the forested soil was sandier in the upper horizons (Ac, Ec, Bwc) and at depth (BC,C) while the agricultural soil contained more sand in the Bt horizons. Other notable differences in texture between the two Tifton soils included more silt in the Apc of the agricultural soil, more clay in the Bwc of the agricultural soil, and more clay in the Bt horizons of the forested soil. The two Fuquay soils were similar in percentages of sand, silt, and clay.

Most of the sands at each site were in the mediumand fine-size ranges (tables 4-6). The mean percent of total sand from these two size fractions ranged from 65 to 70 percent for the six sites. Percentages of very coarse sand were low at all sites (4% or less), while coarse sands ranged from 3.8 to 18.6 percent. Percentages of very fine sand were similar to those of coarse sands, ranging from 1.6 to 17.6 percent. With the exception of the forested Dothan site, all the soils contained more fine than medium sand in the A and B horizons. The forested Dothan had a relatively uniform distribution of medium and fine sand throughout the profile. The C horizons of all soils contained more medium than fine sand, with the difference being most prominent in the forested Fuquay. Differences in the sand fractions between sites for the same soil series included larger percentages of both coarse and fine sand at the forested than at the agricultural Fuquay, larger percentages of both coarse and very fine sand at the agricultural than at the forested Tifton, and more fine sand at the forested than at the agricultural Tifton.

The percentages of coarse and fine silt in the soil pedons varied between locations and with depth (tables 4-6). However, these variations were within a relatively small range. Coarse silt percentages ranged up to 9.8 percent, while fine silt percentages ranged up to 10.3 percent. The upper range in coarse silt percentages was observed in the Btv1 through C horizons of the agricultural Dothan (8.1-9.8%), and in the upper horizons of the forested

Table 4
Dothan series: Particle-size distribution of the forested site in Turner Co. and the agricultural site in Tift Co.

Horizon	Depth (cm)	Whole soil, 2 mm	Total Sand	Total Silt	Total Clay	Sand fractions[1] VC	Sand fractions[1] C	Sand fractions[1] M	Sand fractions[1] F	Sand fractions[1] VF	Silt[2] C	Silt[2] F	Fine clay, 0.0002
		%											
Forested Site													
Ap	0-20	2	85.1	8.8	6.1	2.5	9.9	23.8	33.1	15.8	4.3	4.5	1.2
Bw	20-38	2	81.5	8.8	9.7	1.8	9.6	23.0	32.3	14.8	4.8	4.0	4.5
Bt	38-76	2	65.6	7.3	27.1	2.5	8.5	17.6	25.2	11.8	3.7	3.6	18.2
Btv1	76-129	2	57.8	5.4	36.8	2.7	7.6	15.7	21.1	10.7	3.4	2.0	24.3
Btv2	129-160	5	66.9	5.7	27.4	1.8	7.7	17.2	25.7	14.5	4.1	1.6	17.7
BC	160-184	5	68.6	5.2	26.2	1.9	10.3	22.9	24.3	9.2	3.2	2.0	16.5
C	184-274	-	76.3	3.6	20.1	.8	10.7	29.0	28.6	7.2	3.6	-	11.6
Agricultural Site													
Ap	0-30	3	78.9	12.1	9.0	4.3	13.9	25.4	24.5	10.8	5.9	6.2	4.9
Bt1	30-81	5	59.0	8.5	32.5	3.3	10.5	18.9	18.8	7.5	4.4	4.1	23.2
Bt2	81-104	1	47.6	8.9	43.5	2.6	7.5	14.5	15.6	7.4	5.2	3.7	29.7
Btv1	104-125	2	43.9	13.0	43.1	1.4	4.4	11.4	15.9	10.8	8.1	4.9	27.3
Btv2	125-151	-	52.9	13.1	34.0	1.3	5.7	15.1	17.8	13.0	8.6	4.5	24.3
BC	151-180	-	56.2	13.4	30.4	.8	4.0	14.5	22.6	14.3	8.9	4.5	20.3
C	180-211+	-	55.9	13.8	30.3	1.3	5.7	22.0	19.2	7.7	9.8	4.0	15.8

[1] VC = Very Coarse, 2-1 mm; C = Coarse, 1-0.5 mm; M = Medium, 0.5-0.25 mm; F = Fine, 0.25-0.1 mm; VF = Very Fine, 0.1-0.05 mm.

[2] C = Coarse, 0.05-0.02 mm; F = Fine, 0.02-0.002 mm.

Table 5
Fuquay series: Particle-size distribution of the forested site in Turner Co. and the agricultural site in Tift Co.

Horizon	Depth (cm)	Whole soil, 2 mm	Total			Sand fractions[1]					Silt[2]		Fine clay, 0.0002
			Sand	Silt	Clay	VC	C	M	F	VF	C	F	
		%											
Forested Site													
Ap	0-25	4	87.3	8.6	4.1	1.7	11.0	28.3	35.4	10.9	3.3	5.3	2.0
E	25-65	4	88.8	7.8	4.4	2.2	13.4	28.8	33.5	9.9	2.6	5.2	1.2
Bwc	65-82	10	85.4	7.0	7.6	2.6	12.6	25.8	34.2	10.2	4.2	2.8	12.5
Btc	83-136	24	72.6	6.0	21.4	2.1	10.2	22.8	29.1	8.4	3.2	2.8	12.5
Btv	136-170	3	70.9	2.9	26.2	3.5	13.3	21.7	26.6	5.8	1.7	1.2	14.5
BC	170-186	21	73.4	3.6	23.0	3.9	16.9	23.3	25.0	4.3	1.2	2.4	12.1
C	186-260	TR*	78.3	-	21.7	3.4	18.6	37.8	16.9	1.6	TR	-	10.4
Agricultural Site													
Ap	0-33	1	90.1	7.1	2.8	1.1	5.2	27.2	41.7	14.9	5.5	1.6	2.0
E	33-90	1	85.1	8.9	6.0	1.1	3.8	21.4	41.2	17.6	6.9	2.0	3.2
Bwc	90-106	4	81.7	7.4	10.9	1.5	7.1	24.6	35.7	12.8	4.2	3.2	5.6
Btc	106-128	10	69.1	7.3	23.6	2.5	7.1	20.6	28.1	10.8	4.2	3.2	17.1
Btv	128-156	10	65.0	6.3	28.7	2.6	8.3	20.9	23.9	9.3	4.3	2.0	19.9
BC	156-177	2	66.0	7.7	26.3	.7	6.8	23.1	24.4	11.0	5.3	2.4	15.8
C	177-214+	-	75.5	3.9	20.6	1.2	11.0	31.4	23.6	8.3	3.1	.8	13.7

1 VC = Very Coarse, 2-1 mm; C = Coarse, 1-0.5 mm; M = Medium, 0.5-0.25 mm; F = Fine, 0.25-0.1 mm; VF = Very Fine, 0.1-0.05 mm.
2 C = Coarse, 0.05-0.02 mm; F = Fine, 0.02-0.002 mm.
* TR = Trace.

Table 6
Tifton series: Particle-size distribution of the forested site in Turner Co. and the agricultural site in Tift Co.

Horizon	Depth (cm)	Whole soil, 2 mm	Total			Sand fractions[1]					Silt[2]		Fine clay, 0.0002
			Sand	Silt	Clay	VC	C	M	F	VF	C	F	
		%											
Forested Site													
Ac	0-10	16	79.4	11.1	9.5	2.3	4.8	23.6	38.5	10.2	7.4	3.7	5.4
Ec	10-31	11	83.2	10.7	6.1	2.1	5.2	24.5	41.3	10.1	7.0	3.7	2.4
Bwc	31-38	12	79.7	12.2	8.1	1.7	4.8	24.7	38.9	9.6	7.7	4.5	4.1
Btc	38-69	9	55.9	9.2	34.9	.7	3.9	18.9	26.5	5.9	4.7	4.5	24.4
Bt	69-88	1	51.6	8.6	39.8	.7	3.6	18.5	23.8	5.0	4.5	4.1	28.0
Btv	88-111	2	53.9	9.2	36.9	1.0	3.6	19.0	24.4	5.9	5.1	4.1	23.9
B't	111-148	TR*	59.1	9.4	31.5	1.2	5.3	22.7	24.5	5.4	5.8	3.6	21.0
BC	148-178	1	61.5	5.4	33.1	2.2	7.2	25.6	22.6	3.9	3.8	1.6	23.0
C	178-244	1	77.9	2.8	19.3	3.8	11.1	32.4	26.0	4.6	1.2	1.6	13.7
Agricultural Site													
Apc	0-29	6	74.7	16.2	9.1	2.8	8.9	22.0	28.6	12.4	5.9	10.3	3.7
Bwc	29-41	24	70.7	11.0	18.3	1.6	8.4	18.7	29.2	12.8	5.7	5.3	12.2
Bt1	41-78	9	60.4	8.7	30.9	3.1	8.3	17.2	22.3	9.5	4.6	4.1	21.5
Bt2	78-117	3	62.7	8.1	29.2	2.5	8.1	18.4	23.6	10.1	4.5	3.6	19.9
Btv	117-138	6	59.6	9.6	30.8	2.6	8.1	18.0	21.8	9.1	5.5	4.1	19.4
BC	138-183	TR	50.3	12.0	37.7	1.3	5.7	13.2	18.5	11.6	7.2	4.9	20.7
C	183-218	TR	56.9	11.2	31.9	3.7	12.6	18.4	14.7	7.5	5.9	5.3	19.0

1 VC = Very Coarse, 2-1 mm; C = Coarse, 1-0.5 mm; M = Medium, 0.5-0.25 mm; F = Fine, 0.25-0.1 mm; VF = Very Fine, 0.1-0.05 mm.
2 C = Coarse, 0.05-0.02 mm; F = Fine, 0.02-0.002 mm.
* TR = Trace.

Tifton (7.4-7.7%). The highest percentage of fine silt (10.3%) occurred in the Apc of the agricultural Tifton. Comparisons between sites of the same soil series revealed some differences. The major difference between the Dothan pedons was that the agricultural soil had twice as much coarse as fine silt in the Btv1 through C horizons, while the portions were more equal in the forested soil. Differences in the silt fractions between the two Fuquay soils were minor. Both coarse and fine silt fractions decreased with depth in the forested Fuquay, while only the finer fraction decreased in the agricultural Fuquay. Also, the forested Fuquay contained more fine silt in the surface, while the agricultural Fuquay contained more coarse silt. Differences between the two Tifton soils included more coarse than fine silt in the forested surface horizons (Ac and Ec), more fine than coarse silt in the agricultural Apc, and decreasing percentages of both silt fractions with depth at the forested site.

Percentages of fine clay less than 0.2 μm from the sites ranged from 1.2 to 29.7 percent (tables 4-6). Amounts were low in the A horizons and peaked in the Bt horizons. Soils having the highest fine clay were the agricultural Dothan and the forested Tifton. Comparison of the two Dothan soils showed more fine clay throughout the agricultural pedon, particularly in the Bt horizon. The Fuquay pedons were quite similar, with the agricultural soil having slightly more fine clay in all horizons except the Ap. The forested Tifton contained somewhat more fine clay in the Btc through BC horizons than the agricultural Tifton, but less fine clay in the Bwc and C horizons.

Soil Mineralogy

The mineralogies of the very fine sand and clay fractions (tables 7-9) of selected horizons from the sites were determined by the NSSL according to methods of the Soil Conservation Service (1982, SSIR No. 1 methods 7B1A, 7A2I, 7A3). Both x-ray diffraction and differential thermal analyses were made on the clay fractions. Quartz was the major component of the very fine sand at all sites with percentages ranging from 82-99 percent. These findings support those of Perkins et al. (1979) for the same Coastal Plain soils in Georgia. Significant percentages (4-15%) of kaolinite were found in the very fine sand of the lower horizons of the Tifton soils, particularly at the agricultural site (11-15%), while the very fine sand of the other soil series contained only 1 to 3 percent kaolinite. Opaques in very fine sand were found to range from 1 to 3 percent at each site, while only very small amounts (generally less than 1 percent) of such minerals as pyroxene, rutile, biotite, zircon, hornblende, potassium feldspar, or tourmaline were found in the very fine sand at any of the sites.

X-ray diffraction of the clay fraction showed kaolinite to be dominant or abundant in all horizons from which samples were analyzed, except the forested Tifton Ec, which contained only a moderate amount. Small amounts of vermiculite were found in both Dothan soils, moderate to trace amounts of vermiculite were found in both Fuquay soils, and small to trace amounts of vermiculite were found in each Tifton soil. The minerals, goethite and gibbsite, appeared as trace constituents in each soil, while a trace amount of mica appeared in the B't horizon of the agricultural Tifton. Differential thermal analysis (DTA) showed that 52 to 85 percent of

Table 7
Mineralogy of the Dothan series

Soil horizon	Depth	Mineralogy[1]		
			Clay <2 μM	
		Very fine sand	X-ray	DTA
	(cm)	(%)	(abundance)	(%)
			Forested, Turner Co.	
Bt	38-76	QZ 99, PR 1, KK<1, HN<1, RU<1, ZR<1, OP<1, TR<1	KK 4, VR 2, GI 1 GE 1	KK 65, GI 4
C	184-274	QZ 97, OP 1, KK 1, RU<1, HN<1, PR<1, ZN<1	-	KK 85
			Agricultural, Tift Co.	
Bt1	30-81	QZ 97, KK 1, OP 1, PR<1, RU<1, BT<1, ZR<1, HN<1, PK<1	KK 4, VR 2, GE 1	KK 47, GI 2
BC	151-180	QZ 94, KK 3, OP 2, BT<1, ZR<1 PR<1, HN<1	KK 5, VR 2, GE 1	KK 74

[1] Sand = QZ - Quartz; KK - Kaolinite; OP - Opaques; PR - Pyroxene; RU - Rutile; BT - Biotite; ZR - Zircon; HN - Hornblende; PK - Potassium Feldspar; TR - Tourmaline.

Clay = KK - Kaolinite; VR - Vermiculite; GI - Gibbsite; GE - Goethite.

Abundance = 5 - Dominant; 4 - Abundant; 3 - Moderate; 2 - Small; 1 - Trace.

Table 8
Mineralogy of the Fuquay series

Soil horizon	Depth	Mineralogy[1] Very fine sand	Clay <2 µM X-ray	Clay <2 µM DTA
	(cm)	(%)	(abundance)	(%)
			Forested, Turner Co.	
E	25-65	QZ 99, PR 1, ZR<1, PK<1, OP<1, KK<1, RU<1	-	-
Bt	82-136	QZ 96, KK 2, OP<1, RU<1, PK<1, ZR<1, PR<1, BT<1, HN<1, MS<1	KK 4, VR 2, GI 1, GE 1	KK 58, GI 5
C	186-260	QZ 93, KK 3, ZR 1, OP 1, PR<1	KK 5, VR 1, GE 1	KK 81
			Agricultural, Tift Co.	
E	33-90	QZ 98, PK 1, OP 1, ZR<1, HN<1, PR<1, KK<1	-	-
Bw	90-106	-	KK 5, VR 3, GE 1	KK 52, GI 1
Bt2	128-156	QZ 93, KK 3, OP 2, BT 1, ZR 1, HN<1, PR<1, PK<1, PO<1	KK 5, VR 2, GE 1	KK 66
BC	156-177	-	KK 5, GE 2, VR 1	KK 81

[1] Sand = QZ - Quartz; KK - Kaolinite; OP - Opaques; PR - Pyroxene; RU - Rutile; BT - Biotite; ZR - Zircon; HN - Hornblende; PK - Potassium Feldspar; TR - Tourmaline; PO - Plant Opal; Ms - Muscovite.

Clay = KK - Kaolinite; VR - Vermiculite; GI - Gibbsite; GE - Goethite.

Abundance = 5 - Dominant; 4 - Abundant; 3 - Moderate; 2 - Small; 1 - Trace.

Table 9
Mineralogy of the Tifton series

Soil horizon	Depth	Mineralogy[1] Very fine sand	Clay <2 μM X-ray	DTA
	(cm)	(%)	(abundance)	(%)
			Forested, Turner Co.	
Ec	10-31	QZ 96, OP 2, PR 1, KK 1, ZR<1, HN<1, BT<1, RU<1	KK 3, VR 2	KK 54, GI 1
Btc	38-69	QZ 95, KK 4, PR<1, RU<1, BT<1, OP<1, ZR<1	KK 4, VR 2, GE 1	KK 54, GI 1
B't	111-148	-	KK 5, VR 1, MI 1, GE 1	KK 80
BC	148-178	QZ 87, KK 8, OP 3, ZR 1, HN<1, PR<1, BT<1, MS<1	-	-
			Agricultural, Tift Co.	
Bt1	41-78	QZ 93, KK 5, OP 1, PR<1, HN<1, PK<1, ZR<1, BT<1	KK 5, VR 2, GE 2, GI 1	KK 70, GI 3
Bt2	78-117	QZ 82, KK 15, OP 2, HB<1, ZR<1, BT<1, PR<1	-	-
BC	138-183	QZ 85, KK 11, OP 3, BT<1, HN<1, PR<1, ZR<1	KK 5, GE 2, VR 1	KK 84

[1] Sand = QZ - Quartz; KK - Kaolinite; OP - Opaques; PR - Pyroxene; RU - Rutile; BT - Biotite; ZR - Zircon; HN - Hornblende; PK - Potassium Feldspar; TR - Tourmaline; Ms - Muscovite.

Clay = KK - Kaolinite; VR - Vermiculite; GI - Gibbsite; GE - Goethite.

Abundance = 5 - Dominant; 4 - Abundant; 3 - Moderate; 2 - Small; 1 - Trace.

the clay was kaolinite (tables 7-9). Small amounts of gibbsite (1-5%) were found primarily in the Bt horizons. Clay minerals in these soils are comparable to those reported by other investigators (Fiskell and Perkins 1970, Perkins et al. 1978, 1979) for the same Coastal Plain soils in Georgia.

Bases, Acidity, Extractable Aluminum, and Cation Exchange Capacity

Measurements of NH_4OAc extractable bases, acidity, extractable Al, and cation exchange capacity (CEC) as determined by an NH_4OAc method were made on samples from each site. Analyses were performed at the NSSL by methods 5B5A, 6NE2, 6O2D, 6P2B, 6Q2B, 6H5A, 6G9A, 5A8B of SSIR No. 1 (Soil Conservation Service 1982). Bases measured as NH_4OAc extractable included Ca, Mg, Na, and K (tables 10-15). Information also presented in these tables includes the sum of bases (Ca+Mg+Na+K), sum of cations (sum of bases plus acidity), sum of bases plus Al, and the percentages of Al saturation, base sum, and saturated NH_4OAc CEC (Soil Conservation Service 1982, methods 5A3A, 5A3B, 5G1, 5C3, 5C1). The percent of Al saturation is the extractable Al divided by the sum of the bases plus Al. The percent of the base sum is the sum of bases divided by the sum of the cations. The percent of saturated NH_4OAc determined CEC is the sum of bases divided by the NH_4OAc determined CEC.

Quantities of extractable bases (Ca, Mg, Na, and K) were small, with values ranging from trace to 1.4 milliequivalents/100 g (meq/100 g). Similar data for these Coastal Plain soils have been reported by Carlisle et al. (1978, 1981); Fiskell and Perkins (1970), and Perkins et al. (1978, 1979). Of the four bases, more Ca and Mg were found in the profiles than Na or K. Quantities of Ca and Mg were lowest in the E and upper B horizons. Differences between sites of the same soil series were generally minor. With K, however, the agricultural Tifton contained measurable amounts; whereas, the forested site and the other series sites contained mostly trace amounts.

Soil acidity values ranged from 0.7 to 5.5 meq/100 g. Mean soil acidities were higher at all the agricultural sites than at the forested sites. For the Dothan series, all the agricultural soil horizons had higher acidity values than the corresponding horizons of the forested soil. Acidities were higher in the Bwc through C horizons of the agricultural Fuquay than in the forested Fuquay. In the Tifton series, the agricultural soil contained higher acidities than forested soil in the Apc, Bwc, Btc, and BC horizons.

Extractable Al ranged from 0.1 to 2.8 meq/100 g. The agricultural Dothan and Fuquay series contained more extractable Al than the corresponding horizons in the forested sites. For the Tifton series, values generally were higher at the forested site.

Cation exchange capacities as measured by the NH_4OAc method ranged from 0.7 to 5.3 meq/100 g. Values were consistently higher in the agricultural Dothan than in the forested Dothan. Differences between the two Fuquay pedons included lower CEC in the Ap, E, and Bwc horizons in the agricultural soil, but higher values as compared with the forested soil in the rest of the pedon. The agricultural Tifton had greater CEC than the forested Tifton only in the A, BC, and C horizons.

Base sums (Ca+Mg+Na+K) ranged from 0.2 to 2.1 meq/100 g. Comparison of the two Dothan pedons revealed higher sums in the Bt through C horizons of the forested soil. The base sums of the

forested Fuquay exceeded those of the agricultural Fuquay in the Ap, E, and Bwc horizons, while the agricultural Fuquay had higher values in the Btc through C horizons. The agricultural Tifton consistently had higher base sums than the forested Tifton.

The sum of cations (base sum + acidity) values ranged from 1.1 to 6.9 meq/100 g. Comparisons between difference sites of the same series primarily reflected acidity, which consistently was higher than base sum at each site. For Dothan, the sum of cations was higher throughout the pedon at the agricultural site. The agricultural Fuquay had a higher cation sum than the forested site except for the Ap and E horizons. The agricultural Tifton had a higher cation sum than the forested site except in the Btv horizon.

Bases plus Al ranged from 1.1 to 3.3 meq/100 g. Extractable Al tended to exceed the sum of bases in the lower B and C horizons. Hence, values for bases plus Al were dominated by the Al fraction in the lower part of the pedon. Comparisons between the Dothan pedons showed consistently more bases + Al at the agricultural site. For the Fuquay series, the lower part of the pedon (Btc-C) in the agricultural soil contained more bases plus Al than that in the forested soil. The two Tifton soils were quite similar in sums of bases plus Al.

The three columns of tables 10-15 entitled "sum cats," NH_4OAc, and bases + Al are three measures of CEC. Comparisons of these three measures showed that values were consistently highest for the sum of cations, intermediate for CEC as measured by an NH_4OAc method, and lowest as the sum of bases plus Al.

Percentages of Al saturation, base sum, and saturated NH_4OAc are different ways to examine the importance of H and Al in these soils. The percent Al saturation ranged from 5 to 93 percent and generally increased with depth. Comparison of Al saturation between the two Dothans revealed much higher quantities in the agricultural soil. The agricultural Fuquay had greater Al saturation than the forested Fuquay in the E and Bwc horizons, and lower Al saturation in the Btv horizon. Values for the other horizons of the two pedons were similar. The forested Tifton was more Al saturated than the agricultural soil throughout most of the pedon.

The base sum percentage is an expression of the amount of Ca, Mg, Na, and K relative to H. This percentage ranged from 4 to 50 percent, showing again that H was the dominant cation. Comparison of the two Dothans showed higher base percentages in the forested soil. The agricultural Dothan had low values in the BC and C, indicating H was dominant. Comparisons between the two Fuquay soils showed fluctuation with depth and horizon as to which site had a higher base sum. With the Tifton soils, lower base sum values in the forested soil were observed for the Bt through C horizons.

The sum of bases divided by the saturated NH_4OAc CEC showed the percentage of measured CEC due to bases. The values ranged from 5 to 75 percent. Values in the forested Dothan were consistently higher than in the agricultural Dothan. A comparison of the two Fuquay soils showed fluctuation from horizon to horizon as to which soil contained a higher percentage of measured CEC due to bases. Values for most of the pedon were higher in the agricultural Tifton than in the forested Tifton.

Table 10
Forested Dothan series, Turner Co.:
Cation exchange properties

Horizon	Depth	(NH_4OAc extractable bases) Ca	Mg	Na	K	Sum bases	Acid-ity	Extr Al	CEC Sum cats	NH_4 OAc	Bases +Al	Al sat	Base sum	Sat, NH_4 OAc
	(cm)	(meq/100 g									)	(%		)
Ap	0-20	1.0	0.3	0.1	0.1	1.5	1.9	0.2	3.4	2.9	1.7	12	44	52
Bw	20-38	.4	.1	.1	TR*	.6	1.4	.5	2.0	2.0	1.1	45	30	30
Bt	38-76	1.0	.5	.2	.1	1.8	2.2	.1	4.0	3.0	1.9	5	45	60
Btv1	76-129	.5	.9	.1	TR	1.5	2.8	.2	4.3	3.0	1.7	12	35	50
Btv2	129-160	.1	.3	.8	TR	1.2	2.0	.7	3.2	2.2	1.9	37	37	55
BC	160-184	TR	.1	.4	TR	.5	1.8	.9	2.3	2.2	1.4	64	22	23
C	184-274	.7	TR	TR	TR	.7	.7	.8	1.4	1.2	1.5	53	50	58

* TR = Trace.

Table 11
Agricultural Dothan series, Tift Co.:
Cation exchange properties

Horizon	Depth	(NH_4OAc extractable bases) Ca	Mg	Na	K	Sum bases	Acid-ity	Extr Al	CEC Sum cats	NH_4 OAc	Bases +Al	Al sat	Base sum	Sat, NH_4 OAc
	(cm)	(meq/100 g									)	(%		)
Ap	0-30	1.0	0.4	0.1	0.1	1.6	3.6	0.4	5.2	3.5	2.0	20	31	46
Bt1	30-81	.9	.2	.1	TR*	1.2	4.7	1.0	5.9	3.9	2.2	45	20	31
Bt2	81-104	.4	.3	.4	TR	1.1	5.3	1.6	6.4	4.8	2.7	59	17	23
Btv1	104-125	.5	.5	.1	TR	1.1	5.5	2.1	6.6	5.6	3.2	66	17	20
Btv2	125-151	.5	.5	.2	TR	1.2	4.0	1.6	5.2	4.3	2.8	57	23	28
BC	151-180	.1	.1	.1	TR	.3	4.2	2.1	4.5	3.9	2.4	87	7	8
C	180-211+	.1	.2	.2	TR	.5	4.2	2.5	4.7	3.9	3.0	83	11	13

* TR = Trace.

Table 12
Forested Fuquay series, Turner Co.:
Cation exchange properties

Horizon	Depth	(NH4OAc extractable bases) Ca	Mg	Na	K	Sum bases	Acid-ity	Extr Al	CEC Sum cats	CEC NH4 OAc	CEC Bases +Al	Al sat	Base sum	Sat, NH4 OAc
	(cm)	(-----	-----	-----	-----	meq/100 g	-----	-----	-----	-----	-----)	(-----	%	-----)
Ap	0-25	1.4	0.2	0.2	0.1	1.9	2.3	0.2	4.2	3.0	2.1	10	45	63
E	25-65	.4	.1	.1	TR*	.6	1.9	.1	2.5	.8	.7	14	24	75
Bwc	65-82	.3	.2	TR	TR	.5	1.5	.1	2.0	.8	.6	17	25	62
Btc	82-136	.7	.5	.1	.1	1.4	1.7	.2	3.1	2.4	1.6	13	45	58
Btv	136-170	.1	.2	.2	TR	.5	2.0	.5	2.5	2.0	1.0	50	20	25
BC	170-186	TR	.1	.2	TR	.3	2.1	.5	2.4	1.8	.8	63	13	17
C	186-260	.1	.1	TR	-	.2	2.7	.8	2.9	1.3	1.0	80	7	15

* TR = Trace.

Table 13
Agricultural Fuquay series, Tift Co.:
Cation exchange properties

Horizon	Depth	(NH4OAc extractable bases) Ca	Mg	Na	K	Sum bases	Acid-ity	Extr Al	CEC Sum cats	CEC NH4 OAc	CEC Bases +Al	Al sat	Base sum	Sat, NH4 OAc
	(cm)	(-----	-----	-----	-----	meq/100 g	-----	-----	-----	-----	-----)	(-----	%	-----)
Ap	0-33	0.5	0.3	0.2	0.1	1.1	1.7	-	2.8	1.5	-	-	39	73
E	33-90	.2	.1	.1	TR*	.4	.7	0.2	1.1	.7	0.6	33	36	57
Bwc	90-106	.2	.1	TR	TR	.3	1.9	.4	2.2	1.5	.7	57	14	20
Btc	106-128	1.3	.4	.1	.1	1.9	3.6	.4	5.5	3.2	2.3	17	35	59
Btv	128-156	1.2	.3	.5	TR	2.0	3.6	.6	5.6	3.3	2.6	23	36	61
BC	156-177	.2	.3	.1	TR	.6	3.6	1.7	4.2	3.6	2.3	74	14	17
C	177-214+	.1	.3	.3	TR	.7	2.7	1.5	3.4	2.9	2.2	68	21	24

* TR = Trace.

Table 14
Forested Tifton series, Turner Co.:
Cation exchange properties

Horizon	Depth	Ca	Mg	Na	K	Sum bases	Acid-ity	Extr Al	CEC Sum cats	CEC NH_4OAc	Bases +Al	Al sat	Base sum	Sat, NH_4OAc
		(NH_4OAc extractable bases)												
	(cm)	(meq/100 g)										(%)		
Ac	0-10	0.4	0.1	0.2	TR*	0.7	4.6	1.1	5.3	4.4	1.8	61	13	16
Ec	10-31	.3	.1	.2	TR	.6	2.3	.5	2.9	2.6	1.1	45	21	23
Bwc	31-38	.3	.1	.4	TR	.8	1.2	.3	2.0	1.6	1.1	27	40	50
Btc	38-69	.5	.7	.1	TR	1.3	4.3	.9	5.6	3.9	2.2	41	23	33
Bt	69-88	.4	.8	.2	TR	1.4	4.1	1.2	5.5	4.5	2.6	46	25	31
Btv	88-111	.2	.4	.1	TR	.7	5.1	2.0	5.8	4.5	2.7	74	12	16
B't	111-148	.1	.2	.1	TR	.4	3.7	2.1	4.1	3.8	2.5	84	10	11
BC	148-178	TR	.1	.1	TR	.2	4.0	2.8	4.2	4.0	3.0	93	5	5
C	178-244	TR	.1	.1	TR	.2	4.3	1.7	4.5	2.2	1.9	89	4	9

* TR = Trace.

Table 15
Agricultural Tifton series, Tift Co.:
Cation exchange properties

Horizon	Depth	Ca	Mg	Na	K	Sum bases	Acid-ity	Extr Al	CEC Sum cats	CEC NH_4OAc	Bases +Al	Al sat	Base sum	Sat, NH_4OAc
		(NH_4OAc extractable bases)												
	(cm)	(meq/100 g)										(%)		
Apc	0-29	1.4	0.2	0.2	0.3	2.1	4.8	0.6	6.9	5.3	2.7	22	30	40
Bwc	29-41	.4	.2	.2	.2	1.0	3.7	1.1	4.7	2.8	2.1	52	21	36
Bt1	41-78	.6	.3	.1	.3	1.3	4.9	.8	6.2	2.9	2.1	38	21	45
Bt2	78-117	.8	.4	.1	.3	1.6	4.0	.5	5.6	3.1	2.1	24	29	52
Btv	117-138	.9	.3	.2	.2	1.6	3.7	.5	5.3	3.4	2.1	24	30	47
BC	138-183	1.0	.4	.2	.1	1.7	4.4	1.4	6.1	4.2	3.1	45	28	40
C	183-218	.7	.4	TR*	.1	1.2	3.6	2.1	4.8	4.5	3.3	64	25	27

* TR = Trace.

Comparison of the percentages of base sum and saturated NH_4OAc showed that the base sum percentage was always smaller than the saturated NH_4OAc percentage. This was because CEC as measured by NH_4OAc was always less than the sum of bases plus H. Comparison of all three columns showed in general that the higher the Al saturation in the horizon, the lower the percentages of base sum and saturated NH_4OAc. As the amount of Al increased in the pedon, amounts of the other cations decreased.

pH, Electrolytic Conductivity, Surface Area, Organic Carbon, Total Nitrogen, Extractable Iron and Aluminum, and Total Analyses of K_2O and Iron

Measurements of the pH of the soil horizons (tables 16-21) were made in KCl, $CaCl_2$, and H_2O at the NSSL according to SSIR No. 1 methods 8C1G, 8C1F (Soil Conservation Service 1982). The range of pH's measured in KCl, $CaCl_2$, and H_2O were 3.7-4.3, 4.2-4.9, and 4.4-5.8, respectively. Values from the individual horizons were most similar between the $CaCl_2$ and H_2O methods, while values from the KCl method were frequently lower than the other two methods by 1/2 to 1 pH unit.

Comparisons of KCl measured pH's between sites of the same series showed that both the agricultural Dothan and the agricultural Fuquay pedons had lower pH's than corresponding forested horizons. A comparison of the two Tifton soils showed pH to be slightly lower in the agricultural soil except in the Bt and Btv horizons. When pH was determined in $CaCl_2$, values were similar between the two Dothan soils and the two Tifton soils. The $CaCl_2$ determined pH of the agricultural Fuquay was lower than that of the forested Fuquay except at the soil surface. Comparisons between like soil series of pH measurements in water showed lower values in the agricultural Dothan, lower values in the agricultural Fuquay except for the Ap horizon, and lower values in the agricultural Tifton for the entire pedon as compared with the forested sites. All sites had pH measurements which were quite acid.

Electrolytic conductivity measurements were made on selected horizons of each soil pedon (Soil Conservation Service 1982, method 8I). Values ranged from 0.01 to 0.18 mmhos/cm. For each pedon, conductivities were highest in the A horizon. Although the small number of observations limits comparison between like soil series, in general, the electrolytic conductivities were higher at the agricultural sites. The application of fertilizers over time would increase soil electrolytic conductivity.

Measurements of surface area were made at the NSSL using ethylene glycol monoethyl ether (EGME) by method 7D2 (Soil Conversation Service 1982). Results were expressed in both mg/g and m^2/g. As expressed in mg/g, values ranged from 7 to 27, while values in m^2/g ranged from 21 to 94. Comparisons between like soil series revealed higher values in the agricultural Dothan, higher values at depth in the agricultural Fuquay, and similar values between the two Tifton soils. Values generally increased with depth in the soil pedon in correspondence with increasing clay contents. The observed differences between the agricultural and forested soils were due primarily to differences in clay contents.

The percent organic carbon (OC) was determined for each horizon of each soil by method 6A1C of the Soil Conservation Service (1982). Values ranged from 0.09 to 1.28 percent with most of the OC occurring in the A

Table 16
Forested Dothan series, Turner Co.:
Selected chemical properties

		pH				Surface Area		Orgn	Total	Dith-Cit extractable		Total anal	
Horizon	Depth	KCl	$CaCl_2$	H_2O	Cond	EGME[1]	EGME	C	N	Fe	Al	K_2O	Fe
	(cm)				(mmhos/cm)	(mg/g)	(m^2/g)	(---------	---------	---------	%	---------	---------)
Ap	0-20	4.2	4.9	5.2	0.06	7	24	0.93	0.039	-	-	-	-
Bw	20-38	4.1	4.6	5.0	-	-	-	.58	.022	0.4	0.1	-	-
Bt	38-76	4.3	4.7	5.2	.02	-	-	.33	.019	1.5	.3	0.2	7.0
Btv1	76-129	4.3	4.7	5.2	-	-	-	.20	-	2.2	.4	-	-
Btv2	129-160	4.1	4.4	5.1	.01	17	59	.13	-	1.8	.3	-	-
BC	160-184	4.1	4.7	5.1	-	-	-	.11	-	1.7	.2	-	-
C	184-274	4.0	4.5	4.9	-	12	42	.09	-	0.4	.1	.2	3.1

[1] Ethylene glycol monoethyl ether.

Table 17
Agricultural Dothan series, Tift Co.:
Selected chemical properties

		pH				Surface Area		Orgn	Total	Dith-Cit extractable		Total anal	
Horizon	Depth	KCl	$CaCl_2$	H_2O	Cond	EGME[1]	EGME	C	N	Fe	Al	K_2O	Fe
	(cm)				(mmhos/cm)	(mg/g)	(m^2/g)	(---------	---------	---------	%	---------	---------)
Ap	0-30	4.1	4.7	4.9	0.11	10	35	1.12	0.067	-	-	0.3	4.9
Bt1	30-81	4.0	4.6	5.0	-	27	94	.35	.022	1.8	0.4	-	-
Bt2	81-104	3.9	4.8	5.1	-	-	-	.21	.012	2.3	.5	-	-
Btv1	104-125	3.8	4.7	4.9	-	-	-	.17	-	2.1	.3	-	-
Btv2	125-151	3.8	4.6	4.9	.01	27	94	.18	-	2.0	.3	-	-
BC	151-180	3.8	4.7	4.9	-	-	-	.17	-	1.8	.2	.3	4.8
C	180-211+	3.8	4.3	4.9	-	-	-	.15	-	1.7	.2	-	-

[1] Ethylene glycol monoetnyl ether.

Table 18
Forested Fuquay series, Turner Co.:
Selected chemical properties

Horizon	Depth	pH KCl	pH $CaCl_2$	pH H_2O	Cond	Surface Area EGME[1]	Surface Area EGME	Orgn C	Total N	Dith-Cit extractable Fe	Dith-Cit extractable Al	Total anal K_2O	Total anal Fe
	(cm)				(mmhos/cm)	(mg/g)	(m^2/g)	(%					%)
Ap	0-25	4.2	4.7	5.1	0.10	7	24	1.02	0.040	-	-	-	-
E	25-65	4.3	4.8	5.4	-	7	24	.27	.011	0.2	0.1	-	-
Bwc	65-82	4.2	4.9	5.3	.01	-	-	.14	.007	.3	.1	-	-
Btc	82-136	4.2	4.8	5.2	-	-	-	.20	-	1.4	.3	0.3	6.7
Btv	136-170	4.1	4.7	5.2	.02	17	59	.14	-	2.3	.4	-	-
BC	170-186	4.1	4.8	5.1	-	-	-	.13	-	2.2	.3	-	-
C	186-260	4.0	4.7	4.9	-	13	45	.10	-	.6	.1	.3	4.1

[1] Ethylene glycol monoethyl ether.

Table 19
Agricultural Fuquay series, Tift Co.:
Selected chemical properties

Horizon	Depth	pH KCl	pH $CaCl_2$	pH H_2O	Cond	Surface Area EGME[1]	Surface Area EGME	Orgn C	Total N	Dith-Cit extractable Fe	Dith-Cit extractable Al	Total anal K_2O	Total anal Fe
	(cm)				(mmhos/cm)	(mg/g)	(m^2/g)	(%					%)
Ap	0-33	4.5	4.9	5.8	0.04	6	21	0.51	0.024	-	-	-	-
E	33-90	4.2	4.5	5.2	-	6	21	.22	.006	0.3	0.1	-	-
Bwc	90-106	3.9	4.2	4.8	.03	-	-	.19	.011	.7	.2	0.4	6.3
Btc	106-128	4.1	4.4	5.0	-	-	-	.23	-	2.1	.4	-	-
Btv	128-156	4.0	4.4	5.0	.01	24	84	.18	-	2.4	.3	.3	6.6
BC	156-177	3.9	4.3	4.9	-	-	-	.14	-	2.2	.2	-	-
C	177-214+	3.8	4.4	4.8	-	20	70	.12	-	1.3	.1	-	-

[1] Ethylene glycol monoethyl ether.

Table 20
Forested Tifton series, Turner Co.:
Selected chemical properties

Horizon	Depth	pH KCl	pH $CaCl_2$	pH H_2O	Cond	Surface Area EGME[1]	Surface Area EGME	Orgn C	Total N	Dith-Cit extractable Fe	Dith-Cit extractable Al	Total anal K_2O	Total anal Fe
	(cm)				(mmhos/cm)	(mg/g)	(m^2/g)	(----------------		%			----------------)
Ac	0-10	3.9	4.2	4.7	0.03	12	42	1.20	0.040	0.7	0.2	-	-
Ec	10-31	4.0	4.5	5.1	-	-	-	.66	.022	.4	.1	0.4	4.9
Bwc	31-38	4.1	4.5	5.1	.01	-	-	.43	.015	.6	.1	-	-
Btc	38-69	4.0	4.4	5.0	-	-	-	.37	.020	4.3	.8	.3	6.5
Bt	69-88	3.9	4.5	5.0	.01	-	-	.23	-	2.1	.3	-	-
Btv	88-111	3.8	4.4	4.9	-	25	87	.26	-	2.0	.2	-	-
B't	111-148	3.8	4.6	5.1	.01	-	-	.10	-	1.3	.2	.4	4.7
BC	148-178	3.8	4.6	5.0	-	-	-	.12	-	1.3	.2	-	-
C	178-244	3.8	4.4	4.9	-	16	56	.09	-	.5	.1	-	-

[1] Ethylene glycol monoethyl ether.

Table 21
Agricultural Tifton series, Tift Co.:
Selected chemical properties

Horizon	Depth	pH KCl	pH $CaCl_2$	pH H_2O	Cond	Surface Area EGME[1]	Surface Area EGME	Orgn C	Total N	Dith-Cit extractable Fe	Dith-Cit extractable Al	Total anal K_2O	Total anal Fe
	(cm)				(mmhos/cm)	(mg/g)	(m^2/g)	(----------------		%			----------------)
Apc	0-29	3.8	4.4	4.6	0.18	9	31	1.28	0.054	-	-	-	-
Bwc	29-41	3.7	4.1	4.4	-	-	-	.36	.021	1.2	0.3	-	-
Bt1	41-78	3.8	4.3	4.6	.09	-	-	.23	.016	2.4	.5	0.2	6.5
Bt2	78-117	4.0	4.6	4.9	-	22	77	.21	-	2.1	.4	-	-
Btv	117-138	4.0	4.6	4.8	.04	25	87	.14	-	2.6	.4	-	-
BC	138-183	3.7	4.3	4.5	-	-	-	.11	-	2.8	.4	.3	4.7
C	183-218	3.7	4.4	4.4	-	-	-	.08	-	2.7	.3	-	-

[1] Ethylene glycol monoethyl ether.

pedon when the value for the A horizon was excluded, indicating that the CEC was strictly a function of clay content. The high ratio values for the A, E, and Bwc horizons indicate that part of the CEC in these horizons was due to OC.

Comparisons of the CEC to total percent clay ratios between the two Dothan soils showed that the forested soil had higher ratios in the Ap and Bw horizons. Deeper in the pedon, the ratios were slightly higher in the agricultural Dothan. For the two Fuquay soils, ratios were higher in the forested Ap and E than in the agricultural soils, while the agricultural soil had higher ratios for the Bwc through C horizons. The two Tifton soils were similar except for a higher ratio in the agricultural Apc than in the forested Ac and Ec. Differences in ratios between the Ap and Bw horizons of the Dothan and Fuquay series were attributable to combinations of differences in both CEC and clay content rather than differences in a single factor. However, the higher ratios lower in the pedon for both the agricultural Dothan and the agricultural Fuquay as compared with the respective forested soils were due to higher CEC in the agricultural soils.

The ratio of 15-bar moisture retention to percent clay (tables 22-27) serves as a measure of how the clay fraction dominates soil moisture retention at the wilting point for these soils (SSIR No. 1 method 8D1, Soil Conservation Service 1982). This ratio is also used to determine completeness of dispersion. Values ranged from 0.25 - 0.46 for the pedons. The highest ratios for the forested Fuquay and the forested Tifton appeared in the A horizons, showing both that clay percentages were lower in the A horizons and that organic matter in these horizons was retaining moisture or causing incomplete dispersion. Distinctly higher values for the A horizons at the other sites were not observed. Values were very similar for the two Dothan soils, being somewhat higher in the forested soil throughout the pedon. Comparisons of the two Fuquay soils showed values in the Ap and E to be higher in the forested soil, while the values in the rest of the pedon were higher in the agricultural soil. For the two Tifton soils, ratios were higher in the agricultural soil in the Btv through C horizons, while values were similar between the two soils in the upper part of the pedon. The ratios for all six pedons tended to decrease from the Ap horizon to the E and/or Bwc horizons, were somewhat higher in the Bt through BC horizons, and then decreased in the C horizon. This presumably relates to the translocation of fine clays from the A and E horizons to the Bt horizons.

Measurements were made of the liquid limits and the plasticity indexes (tables 22-27) on selected horizons from the six sites by methods 4F1, 4F of SSIR No. 1 (Soil Conservation Service 1982). The liquid limit is the moisture content at which the soil becomes semifluid while the plasticity index is the difference between the plastic limit and the liquid limit and serves as a measure of the clayeyness of a soil. Values for both the liquid limit and the plasticity index generally increase as clay content increases. Values for the liquid limits ranged from 26 to 45. Values were higher in the agricultural pedons due to higher percentages of clay. Differences in the liquid limit were particularly evident in the C horizons of the Tifton soils where the agricultural pedon had a value of 45 and the forested pedon had a value of 24. This was due to the agricultural C horizon having 32 percent clay as compared with 19 percent clay in the forested Tifton C

Table 22
Forested Dothan series, Turner Co.:
Selected physical properties

Horizon	Depth	(Ratio/clay) CEC	15 BAR	Atterburg limits LL	PI	Bulk Density 1/3-bar clod	Dry clod	Oven-dry core	COLE, whole soil	Borehole shear Cohesion	Slope
	(cm)			(% E0.4 mm)		(--------g/cm³-------)			(cm/cm)	(-----bars-----)	
Ap	0-20	0.48	0.36	-	-	1.63	1.65	1.49	0.004	-	-
Bw	20-38	.21	.29	-	-	1.63	1.65	1.69	.004	-	-
Bt	38-76	.11	.32	26	14	1.67	1.72	1.71	.010	0.037	0.047
Btv1	76-129	.08	.33	-	-	1.58	1.63	1.70	.010	.047	.062
Btv2	129-160	.08	.35	30	14	1.86	1.89	1.90	.005	.001	.051
BC	160-184	.08	.37	-	-	1.88	1.90	1.91	.003	-	-
C	184-274	.06	.28	22	7	2.01	2.03	2.02	.003	.057	.062

Table 23
Agricultural Dothan series, Tift Co.:
Selected physical properties

Horizon	Depth	(Ratio/clay) CEC	15 BAR	Atterburg limits LL	PI	Bulk Density 1/3-bar clod	Dry clod	Oven-dry core	COLE, whole soil	Borehole shear Cohesion	Slope
	(cm)			(% E0.4 mm)		(--------g/cm³-------)			(cm/cm)	(-----bars-----)	
Ap	0-30	0.39	0.38	-	-	1.72	1.73	1.53	0.002	-	-
Bt1	30-81	.12	.34	-	-	1.62	1.67	1.58	.010	.083	.061
Bt2	81-104	.11	.36	42	17	1.63	1.68	1.55	.010	.010	.036
Btv1	104-125	.13	.37	-	-	1.64	1.72	1.56	.016	-	-
Btv2	125-151	.13	.37	39	17	1.57	1.65	1.62	.017	.073	.042
BC	151-180	.13	.38	-	-	1.80	1.85	1.77	.009	-	-
C	180-211+	.13	.35	40	18	1.80	1.88	1.74	.015	.126	.041

Table 24
Forested Fuquay series, Turner Co.:
Selected physical properties

Horizon	Depth	(Ratio/clay) CEC	15 BAR	Atterburg limits LL	PI	Bulk Density 1/3-bar clod	Dry clod	Oven-dry core	COLE, whole soil	Borehole shear Cohesion	Slope
	(cm)			(% E0.4 mm)		(--------g/cm³-------)			(cm/cm)	(-----bars-----)	
Ap	0-25	0.73	0.46	-	-	1.73	1.73	1.37	-	-	-
E	25-65	.18	.25	-	-	1.71	1.72	1.78	0.002	0.018	0.045
Bwc	65-82	.11	.24	-	NP	1.69	1.73	1.80	.007	-	-
Btc	82-136	.11	.33	-	-	1.65	1.69	1.75	.007	.022	.050
Btv	136-170	.08	.33	29	8	1.86	1.89	1.81	.005	-	-
BC	170-186	.08	.37	-	-	1.84	1.86	1.85	.003	-	-
C	186-260	.06	.31	31	14	1.95	1.97	1.87	.003	-	-

Table 25
Agricultural Fuquay series, Tift Co.:
Selected physical properties

Horizon	Depth	(Ratio/clay) CEC	15 BAR	Atterburg limits LL	PI	Bulk Density 1/3-bar clod	Dry clod	Oven-dry core	COLE, whole soil	Borehole shear Cohesion	Slope
	(cm)			(% E0.4 mm)		(--------g/cm³-------)			(cm/cm)	(-----bars-----)	
Ap	0-33	0.54	0.39	-	-	1.70	-	1.54	-	-	-
E	33-90	.12	.20	-	-	1.63	1.64	1.59	0.002	0.092	0.017
Bwc	90-106	.14	.34	-	NP	1.67	1.71	1.59	.008	.131	.026
Btc	106-128	.14	.39	-	-	1.63	1.68	1.61	.009	-	-
Btv	128-156	.12	.38	37	20	1.66	1.72	1.73	.011	.012	.036
BC	156-177	.14	.38	-	-	1.87	1.92	1.79	.009	-	-
C	177-214+	.14	.35	32	14	1.83	1.90	1.74	.013	.108	.031

Table 26
Forested Tifton series, Turner Co.:
Selected physical properties

		(Ratio/clay)		Atterburg limits		Bulk Density			COLE, whole soil	Borehole shear	
Horizon	Depth	CEC	15 BAR	LL	PI	1/3-bar clod	Dry clod	Oven-dry core		Cohesion	Slope
	(cm)			(% E0.4 mm)		(--------g/cm^3-------)			(cm/cm)	(-----bars-----)	
Ac	0-10	0.46	0.43	-	-	1.32	1.41	1.25	0.020	-	-
EC	10-31	.43	.39	-	-	1.61	1.66	1.66	.010	-	-
Bwc	31-38	.20	.37	-	NP	1.70	-	-	-	-	-
Btc	38-69	.11	.35	-	-	1.57	1.64	1.71	.014	-0.010	0.052
Bt	69-88	.11	.35	-	-	1.58	1.66	1.61	.017	-	-
Btv	88-111	.12	.34	-	-	1.78	1.84	1.74	.011	.009	.052
B't	111-148	.12	.34	34	17	1.92	1.95	1.85	.005	-	-
BC	148-178	.12	.33	-	-	1.89	1.93	1.88	.007	.018	.052
C	178-244	.11	.29	24	9	1.90	1.93	1.87	.005	-.075	.062

Table 27
Agricultural Tifton series, Tift Co.:
Selected physical properties

		(Ratio/clay)		Atterburg limits		Bulk Density			COLE, whole soil	Borehole shear	
Horizon	Depth	CEC	15 BAR	LL	PI	1/3-bar clod	Dry clod	Oven-dry core		Cohesion	Slope
	(cm)			(% E0.4 mm)		(--------g/cm^3-------)			(cm/cm)	(-----bars-----)	
Apc	0-29	0.58	0.40	-	-	1.77	1.79	1.72	0.004	-	-
Bwc	29-41	.15	.32	-	-	1.78	1.81	2.00	.005	-	-
Bt1	41-78	.09	.37	29	15	1.67	1.73	1.82	.011	0.030	0.039
Bt2	78-117	.11	.36	-	-	1.65	1.70	1.67	.010	.061	.028
Btv	117-138	.11	.40	35	18	1.67	1.73	1.67	.011	-	-
BC	138-183	.11	.36	-	-	1.74	1.79	1.70	.009	-.058	.056
C	183-218	.14	.37	45	29	1.76	1.86	1.82	.019	.023	.052

horizons. Comparisons between the two Dothan soils showed slightly more OC in the agricultural Ap, while the forested Bw and Bt contained more OC than the agricultural soil. Values for the rest of the two Dothan pedons were similar. The two Fuquay pedons were similar in OC except in the Ap horizon, with the forested soil having twice as much OC as the agricultural soil. More OC was found in the forested Tifton than in the agricultural Tifton. The similarities in the OC fraction of particles less than 2 mm between the forested and agricultural soils probably occurred because the agricultural soils had been in bahiagrass for several years. If the agricultural soils had been in row crops, the OC content might have been smaller.

Measurements of total N percentages were made on the upper three or four horizons of each soil (Soil Conservation Service 1982, SSIR No. 1 method 6B3A). Values ranged from 0.011 to 0.067 percent and were highest in the A horizons. The agricultural Dothan Ap contained more total N than the forested Dothan Ap, while the forested Fuquay Ap had higher total N than the agricultural Fuquay Ap. The agricultural Tifton Apc had slightly more total N than the forested Tifton Ac. Values for total N in the subsoils were lowest in the Fuquay soils, and similar among all four Dothan and Tifton soils.

Determinations were made of Fe and Al by dithionate-citrate extraction (Soil Conservation Service 1982, SSIR No. 1 methods 6C2B, 6G7A). The range for dithionate-citrate extractable Fe was from 0.2 to 4.3 percent. Values were lowest near the surface, increased to a maximum in the Bt horizons, and generally decreased in the C horizon of each pedon. This pattern corresponded with the occurrence of plinthite. More Fe was present in the Bw and Bt horizons of the agricultural Dothan than in the same horizons of the forested Dothan. Differences between the two Fuquay soils were rather small. The forested Tifton Btc horizon contained more Fe than the corresponding agricultural Tifton Btc, while the agricultural soil had higher values in the BC and C horizons. The agricultural Tifton did not show a decrease in Fe concentrations in the BC and C horizons similar to that of the other pedons. Values of the dithionate-citrate extractable Al ranged from 0.1 to 0.8 percent. Little difference was observed between the same soil series at the forested or agricultural sites. The highest value of 0.8 percent was found in the forested Tifton Btc horizon.

Hydrogen fluoride (HF) dissolution was used for total analyses of K_2O and Fe (Soil Conservation Service 1982, SSIR No. 1 methods 6Q3A, 6C7A). Values for K_2O ranged from 0.2 to 0.4 percent while values for Fe ranged from 3.1 to 7.0 percent. The Fe values from this method were observably higher than those from the dithionate-citrate extractable method, which gave values ranging from 0.2 to 4.3 percent, with most of the values less than 2.8 percent.

Ratios of Cation Exchange Capacity and 15-Bar Moisture Retention to Clay, Liquid Limits, and Plasticity Indexes

Values for the ratio of cation exchange capacity (CEC) as determined by the NH_4OAc method to total percent clay (tables 22-27) ranged from 0.06 to 0.73 (Soil Conservation Service 1982, method 8D1). Values were highest in the A horizons and lower in the rest of the pedon. The lower values beneath the A horizons were due to greater clay concentrations and decreased OC. For several of the pedons, the ratio was relatively constant throughout the

horizon. The plasticity indexes ranged from nonplastic to 24. Because of the higher clay contents, values again were highest in the agricultural soil.

Bulk Densities and the Coefficient of Linear Extensibility (COLE)

Measurements of bulk density (Db) were made at the NSSL by methods 4A1D and 4A1H on 7x7 cm clod samples from the horizons of each soil at 1/3 bar moisture content and when oven dry (tables 22-27). Measurements of the Db of oven-dry core samples were made at the SEWRL (tables 22-27). The clod samples were collected and dipped in SARAN[2] according to NSSL procedures, while the core samples were collected in 7.6x7.6 cm rings using a core driver. The Db of the clods were determined at both 1/3-bar moisture content and when oven-dry, because clod volumes shrink with oven-drying; this information can be used to calculate the coefficient of linear extensibility (COLE), (SSIR No. 1 method 4D1, Soil Conservation Service 1982). Bulk densities of clods at 1/3-bar moisture tension varied over a range of 1.32 to 2.01 g/cm^3. The lowest values from all six pedons occurred in the A horizons, although not every A horizon had low Db. Bulk densities of horizons within each pedon varied, with the only consistent trend for all six pedons being higher Db in the BC and C horizons. Comparison of the two Dothan pedons revealed similar Db in the epipedon, while the forested Dothan had greater Db in the Btv2 through C horizons. Each Dothan pedon had horizons of lower Db in the Btv's, with the Btv1 being the horizon of low Db for the forested soil, and the Btv2 being the horizon of low Db for the agricultural soil. The Ap horizon of the agricultural Dothan had higher Db than the Bw, indicating that compaction from agricultural machinery may have occurred.

The forested Fuquay 1/3-bar clod samples had Db in the range of 1.65 through 1.73 g/cm^3 for the Ap through Btc horizons. Densities then increased to the range of 1.86-1.95 g/cm^3 for the rest of the pedon, with the highest value occurring in the C horizon. The Ap of the agricultural Fuquay had a Db of 1.70 g/cm^3, while Db of the horizons from the E through the Btv ranged from 1.63 to 1.67 g/cm^3. The higher Db in the Ap as compared with the E again is attributable to agricultural traffic. Bulk densities of the BC and C horizons ranged from 1.83 to 1.87 g/cm^3. The forested Fuquay Db were greater than the agricultural Fuquay Db in all horizons except the BC, although differences commonly were small.

The forested Tifton Ac horizon had the lowest Db of any observed at the six sites. Of the Ec through Btv horizons at the forested Tifton, the Ec, Btc, and Bt horizons had Db in the range of 1.57-1.61 g/cm^3, while the Bwc and Btv horizons had higher Db values. Bulk densities were notably higher in the B't through C horizons, ranging from 1.89-1.92 g/cm^3. Bulk densities of the agricultural Tifton Apc and Bwc horizons were high, even slightly exceeding the Db of the BC and C horizons. Based on Db information and location within the farm, it appears that this site probably was used at one period to park farm machinery. The

[2] Trade names are used in this publication solely for the purpose of providing specific information. Mention of a trade name does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture or an endorsement by the Department over other products not mentioned.

agricultural Tifton had higher Db values than the forested Tifton in the upper pedon, while the forested pedon had higher Db values in the Bt through C horizons. The observed differences within the individual soil pedons and between pedons of the same soil series were the same for the oven-dry clod measurements as for the 1/3-bar clod measurements. Bulk densities were higher from the oven-dry clod method than from the 1/3-bar clod method due to the shrinkage in the volume following oven drying.

Bulk densities measured by the oven-dry core method were somewhat different from those by the oven-dry clod method. Differences between the two methods can be attributed primarily to the fact that the core method may include space between clods as part of the volume. Biased results from the clod method may also result from deeper penetration of SARAN into sands than that assumed for calculations.

Bulk densities of the A horizons of the forested and agricultural Dothan soils were lower as measured by the core method than by the clod method. The core method Db values at the agricultural site were lower for all horizons than the clod method Db values. Core method Db values ranged from 1.53 to 1.74 g/cm^3, while clod method Db values ranged from 1.73 to 1.88 g/cm^3. For the forested Dothan, Db values were similar by both methods except in the Bw and Btvl horizons, where the core method yielded somewhat higher Db values. In the agricultural Fuquay, Db values were consistently lower by the core method, ranging from 1.54-1.79 g/cm^3, while clod method Db values ranged from 1.64-1.92 g/cm^3. The core method showed lower Db values for the forested Fuquay Ap than the clod method, 1.37 g/cm^3 versus 1.73 g/cm^3, while the core method gave higher Db values for the E, Bwc, and Btc horizons. Bulk densities by the clod method in the forested Fuquay were greater for the Btv, BC, and C horizons.

The clod method yielded higher bulk densities than the core method for all horizons of the forested Tifton except the Ec and Btc. Similarly, values by the clod method were higher in the agricultural Tifton except in the Bwc and Btc. These two horizons in the agricultural Tifton were part of a traffic pan, with the higher values by the core method indicating that traffic had compressed clods together.

A general comparison of the clod and core methods of bulk density is shown in table 28. This table includes clod and core method bulk densities for 20 sites separate from this study, plus the 42 values from the LRW sites. Of the total 62 values, 46 bulk densities were higher by the clod method, 10 higher by the core method, and 6 about equal. For the LRW sites, 69 percent of the Db values were higher by the clod method; while of the other sites, 85 percent were higher by this method. Clod Db determinations were more consistently higher at the LRW agricultural sites than at the forested sites.

Values for the coefficient of linear extensibility (COLE) ranged from 0.002 to 0.020. Values generally were lower near the soil surface and increased with depth in the pedon. The B horizons showed greater shrink-swell capacity than the A horizons, while some C horizons showed lower and others showed higher shrink-swell capacity than the B horizons. Comparison of the two Dothan pedons showed higher COLE values in the agricultural soil for the Bw through C horizons. Similarly, COLE values were higher in the agricultural Fuquay than in the forested Fuquay. The forested Tifton pedon had higher COLE

Table 28
Bulk density of selected Coastal Plain soils by the clod and core methods

Soil series	Horizon	Depth	Sand	Silt	Clay	Clod (5x5 cm)	Core[1]
		(cm)	(----------%---------)			(----g/cm^3-----)	
		Selected Coastal Plain Sites					
Tifton	ABc-BAc	20-34	67	16	17	1.72*	1.77
Norfolk	BA	27-36	72	10	18	1.80	1.59
Norfolk	AB-BA	22-38	73	11	16	1.82	1.65
Norfolk	BA	21-40	76	9	15	1.70	1.58
Tifton	Apc	0-13	90	5	5	1.68*	1.53
Tifton	Bt2	66-99	61	9	30	1.98	1.86
Carnegie	Apc	0-15	80	7	13	1.69*	1.60
Carnegie	Btc1	15-48	59	11	30	1.69	1.64
Carnegie	Bt2	48-91	63	9	28	1.86	1.66
Tifton	Bt2	50-102	45	21	34	1.86	1.70†
Fuquay	Bt1	69-110	59	14	27	1.52	1.48†
Varina	Bt2	46-99	41	18	41	1.79	1.66†
Norfolk	Bt2	96-130	65	12	23	1.62	1.54†
Pelham	Btg1	86-142	60	15	25	1.63	1.46†
Marlboro	Bt2	61-96	46	17	37	1.63	1.44†
Tifton	C	152+	72	7	21	1.94	1.74†
Carnegie	Btc1	51-66	69	11	23	1.79	1.74†
Cowarts	Bt1	48-89	68	7	25	1.84	1.69†
Cowarts	Bt1	54-110	69	9	22	1.67	1.71†
Irvington	Bx	76-155	50	26	24	1.96	1.84†
		Sites From the LRW Study					
Dothan	Ap	0-30	79	12	9	1.73	1.53
Dothan	Bt1	30-81	59	8	33	1.67	1.58
Dothan	Bt2	81-104	48	9	43	1.68	1.55
Dothan	Btv1	104-125	44	13	43	1.72	1.56
Dothan	Btv2	125-151	53	13	34	1.65	1.62
Dothan	BC	151-180	56	13	30	1.85	1.77
Dothan	C	180-211+	56	14	30	1.88	1.74
Dothan	Ap	0-20	85	9	6	1.65	1.49
Dothan	Bw	20-38	81	9	10	1.65	1.69
Dothan	Bt	38-76	66	7	27	1.72	1.71
Dothan	Btv1	76-129	58	5	37	1.63	1.70
Dothan	Btv2	129-160	67	6	27	1.89	1.90
Dothan	BC	160-184	69	5	26	1.90	1.91
Dothan	C	184-274	76	4	20	2.03	2.02
Fuquay	E	33-90	85	9	6	1.64	1.59
Fuquay	Bwc	90-106	82	7	11	1.71	1.59
Fuquay	Btc	106-128	69	7	24	1.68	1.61
Fuquay	Btv	128-156	65	6	29	1.72	1.71

Table 28
Bulk density of selected Coastal Plain soils by the clod and core methods--Continued

Soil series	Horizon	Depth	Sand	Silt	Clay	Clod (5x5 cm)	Core[1]
		(cm)	(----------	%---------	)	(----g/cm^3	-----)
Fuquay	BC	156-177	66	8	26	1.92	1.79
Fuquay	C	177-214+	76	4	20	1.90	1.74
Fuquay	Ap	0-25	87	9	4	1.73	1.37
Fuquay	E	25-65	88	8	4	1.72	1.78
Fuquay	Bwc	65-82	85	7	8	1.73	1.80
Fuquay	Btc	82-136	73	6	21	1.69	1.75
Fuquay	Btv	136-170	71	3	26	1.89	1.81
Fuquay	BC	170-186	73	4	23	1.86	1.85
Fuquay	C	186-260	78	-	22	1.97	1.87
Tifton	Apc	0-29	75	16	9	1.79	1.72
Tifton	Bwc	29-41	71	11	18	1.81	2.00
Tifton	Bt1	41-78	60	9	31	1.73	1.82
Tifton	Bt2	78-117	63	8	29	1.70	1.67
Tifton	Btv	117-138	60	9	31	1.73	1.67
Tifton	BC	138-183	50	12	38	1.79	1.70
Tifton	C	183-218	57	11	32	1.86	1.82
Tifton	Ac	0-10	79	11	10	1.41	1.25
Tifton	Ec	10-31	83	11	6	1.66	1.66
Tifton	Btc	38-69	56	9	35	1.64	1.71
Tifton	Bt	69-88	52	8	40	1.66	1.61
Tifton	Btv	88-111	54	9	37	1.84	1.74
Tifton	B't	111-148	59	9	32	1.95	1.85
Tifton	BC	148-178	62	5	33	1.93	1.88
Tifton	C	178-244	78	3	19	1.93	1.87

[1] 7.6x7.6-cm cores unless otherwise specified.

* In plastic net.
† Small cores.

values than the agricultural Tifton except in the BC and C horizons. The shrink-swell capacity of these horizons as measured by COLE relates to the amount of clay present.

Bore-hole shear was determined on selected horizons from the sites according to Wineland (1975). Cohesion values ranged from -0.075 to 0.131 bars while slope values ranged from 0.017 to 0.062 bars. Cohesion values were higher at the agricultural sites than at the forested sites.

Soil Moisture Retention and Saturated Hydraulic Conductivity

Soil moisture retention measurements were made at the SEWRL on 344 cm^3 core samples from each site using Tempe cells and pressure extraction plates. Individual (Tempe cell) pressure extraction plates were used for the 1-100 kPa observations. The cores were then moved to larger pressure extraction plates (5-bar plates) for measurement of soil moisture retention at 300 and 500 kPa. Separate disturbed soil samples from each core were used for soil moisture retention measurements at 1500 kPa (15-bar pressure extraction plate). Soil moisture retention of each individual core up to 5 kPa plus the replicate measurements on disturbed samples at 1500 kPa are contained in Appendix. Regression equations by horizon for soil moisture retention were developed using a log-log relationship between matric suction Ψ and volumetric water content Θ (figs. 1-6). Water retention difference (WRD) for each horizon was calculated as the difference between that retained at 33 and 1500 kPa (tables 29-31).

Soil moisture retention related primarily to soil texture. As clay contents by horizon increased, the percent moisture on a volumetric basis increased. Hence, the lowest volumetric moisture contents for each soil pedon occurred in the sandy surface horizons, while contents increased with depth in the pedon, frequently reaching a maximum in the Bt horizons. Soil moisture retention at 33 kPa varied from 0.09 to 0.34 cm^3/cm^3, while that at 1500 kPa varied from 0.04 to 0.29 cm^3/cm^3. Despite changes in the ranges of soil moisture retention within the pedons, the WRD between 33 and 1500 kPa was fairly uniform, ranging from 0.04 to 0.08 cm^3/cm^3. The mean WRD for each pedon was 0.06 cm^3/cm^3.

Comparison of soil moisture retention between the two Dothan soils showed the values to be higher in the agricultural soil due to higher clay and silt percentages. The two Fuquay pedons had similar moisture retention except for the Btv through C horizons, where moisture retention in the agricultural soil was higher due to more clay and silt. Soil moisture retention in the Apc of the agricultural Tifton was higher than that of the forested Tifton Ac. This was probably related to compaction by agricultural machinery in the agricultural site. As soils are compacted, the number of finer pores increases; hence, more water is retained at lower pressures. Comparisons of soil moisture retention by the three soil series showed lower moisture retention deeper in the pedon of the Fuquay series since this series is characterized by a thick sandy epipedon.

Saturated hydraulic conductivities (cm/hr) were determined on the core samples collected from each site at the SEWRL (tables 29-31). Saturated hydraulic conductivity was measured on individual 7.6x7.6 cm cores by collecting the water passing through the core in 1 hour under a 2.54 cm head.

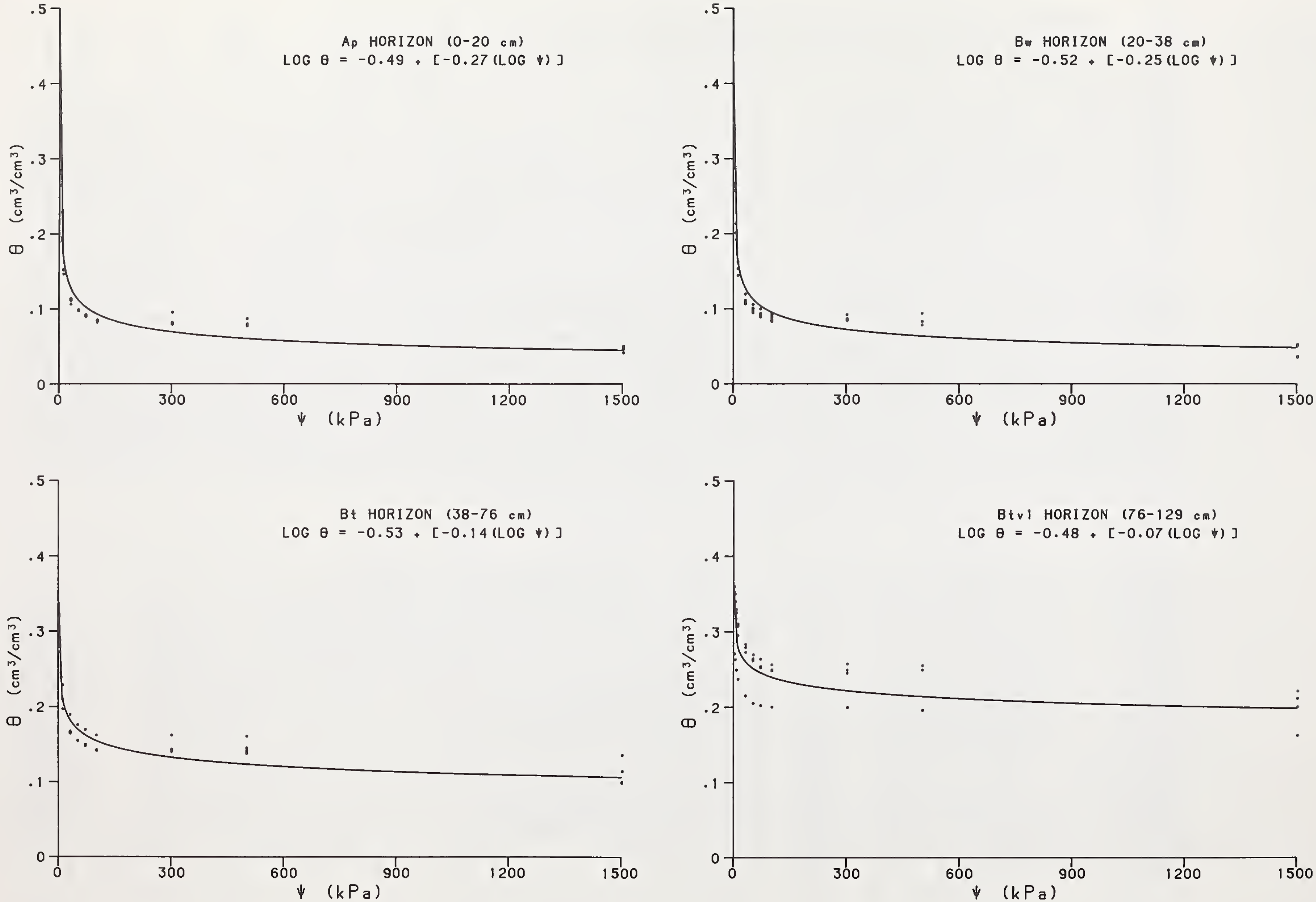


Figure 1.--Forested Dothan series, Turner Co.: Soil water retention for specific soil horizons.

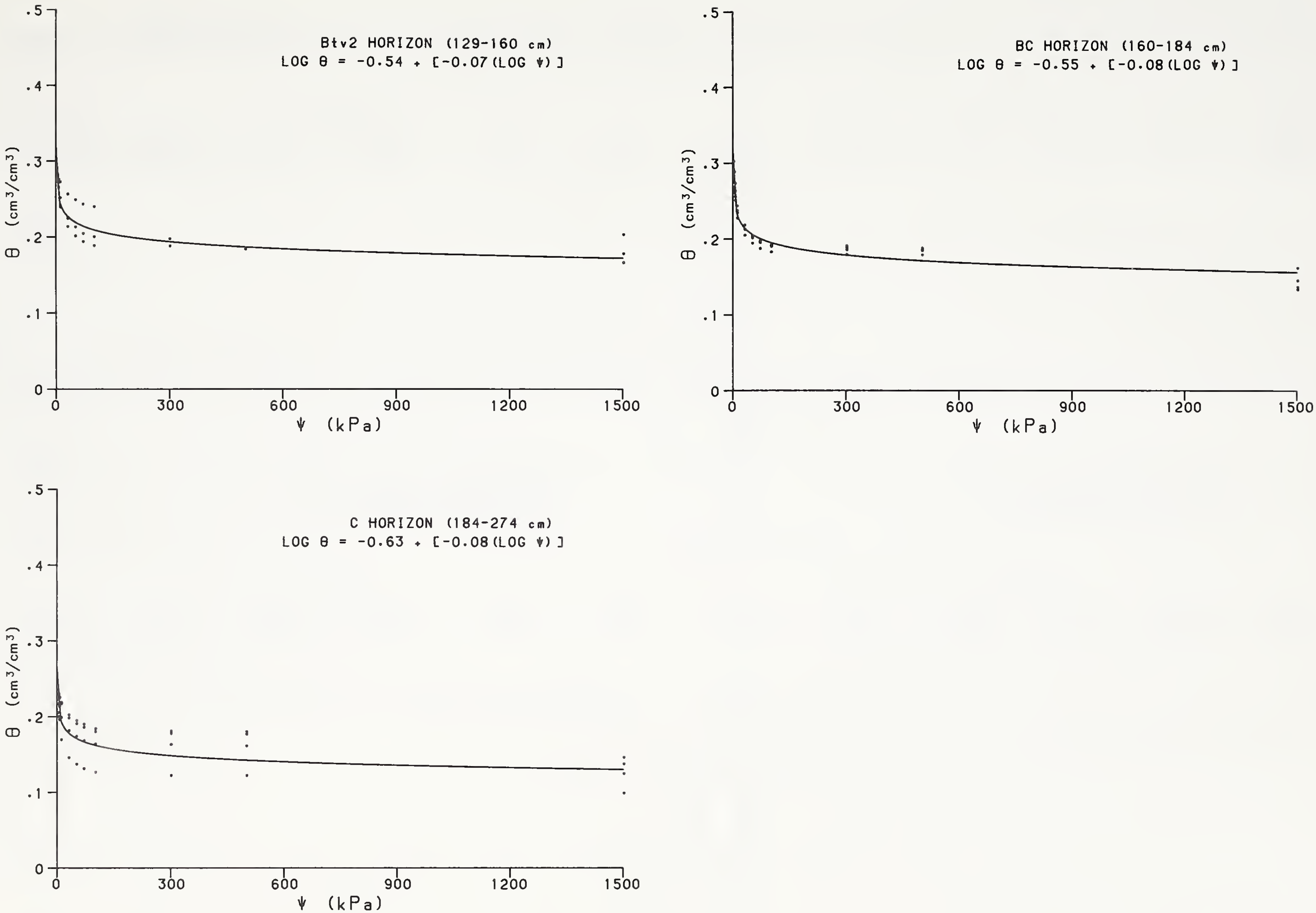


Figure 1.--Forested Dothan series, Turner Co.: Soil water retention for specific soil horizon--Con.

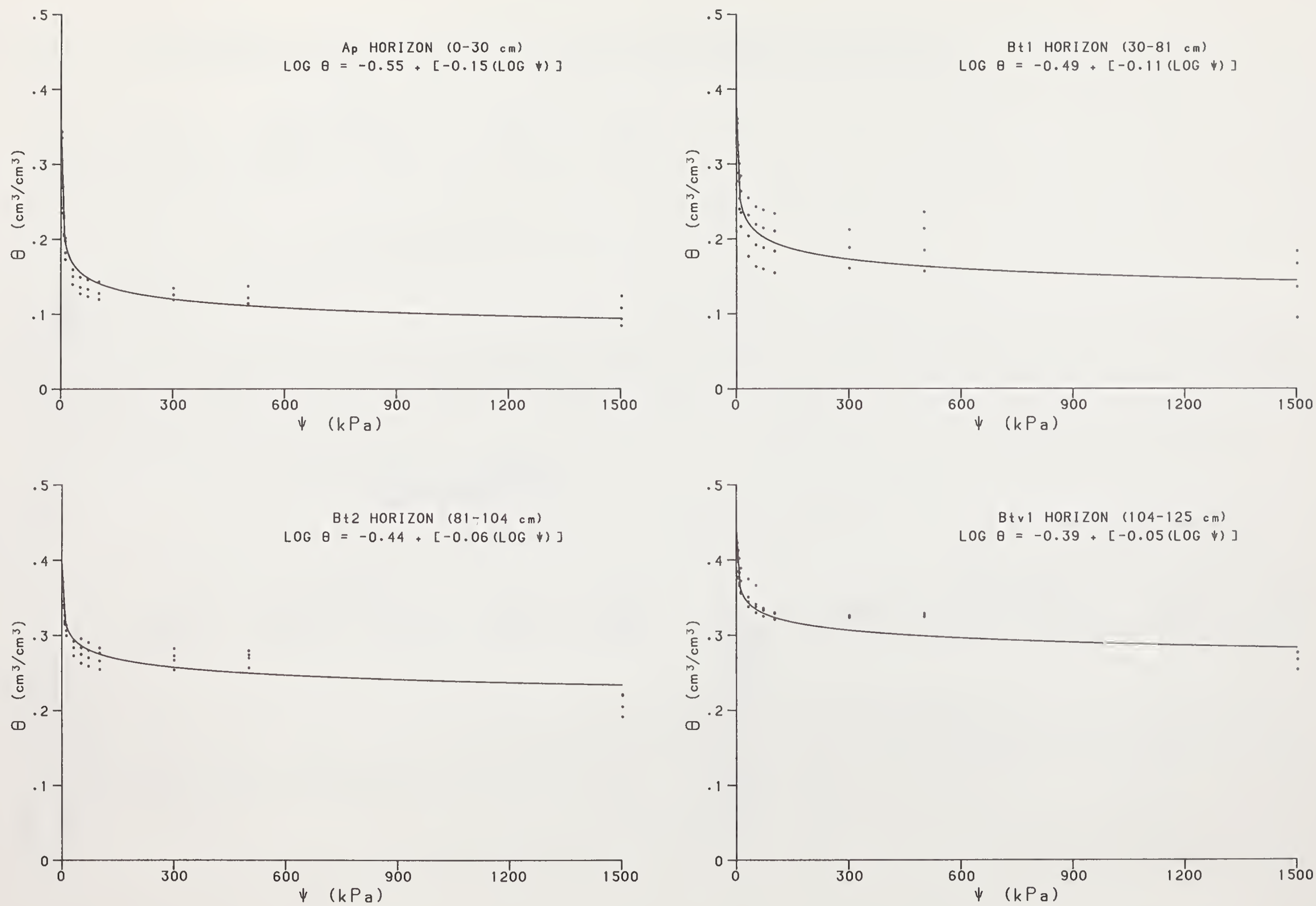


Figure 2.--Agricultural Dothan series, Tift Co.: Soil water retention for specific soil horizons.

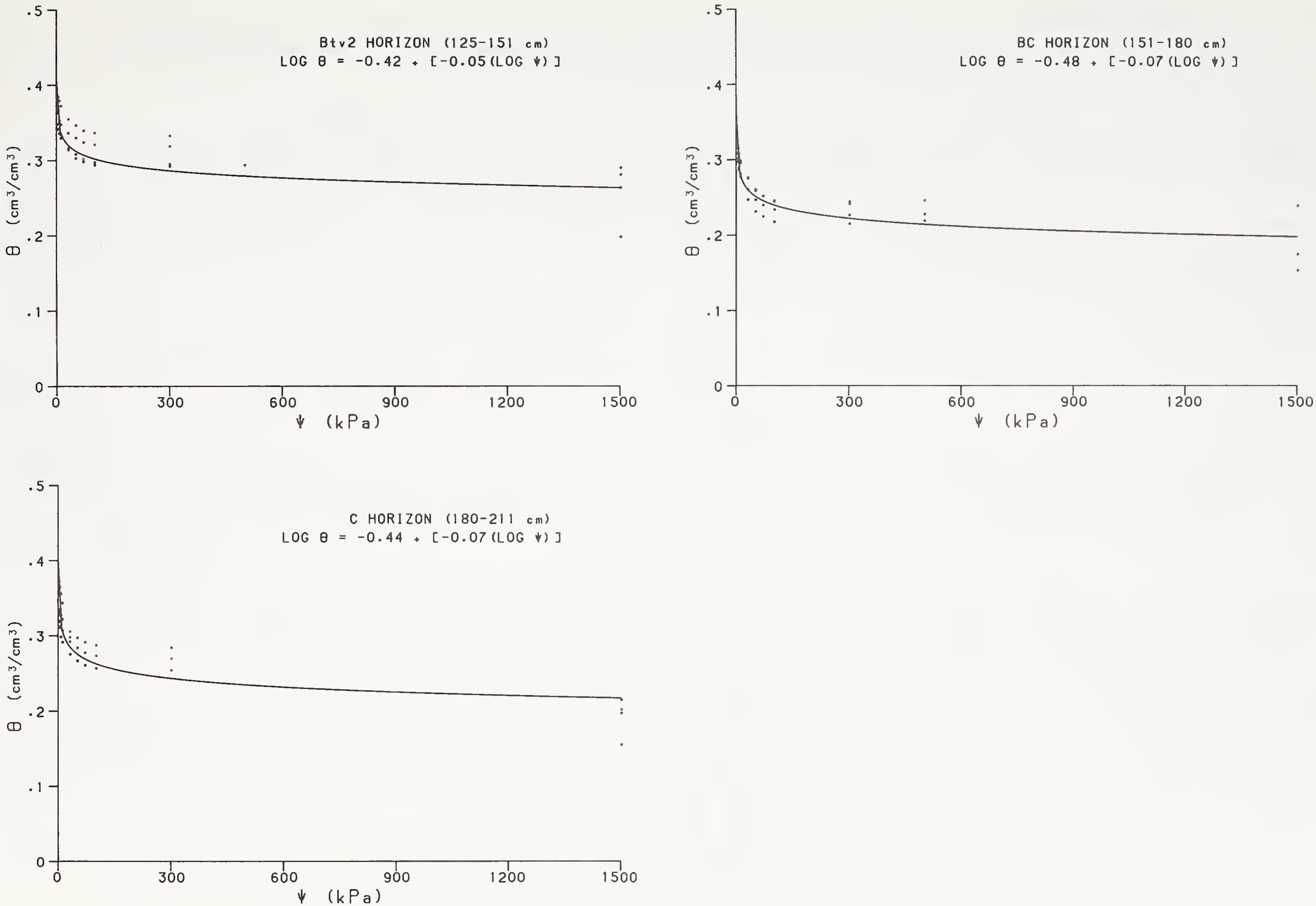


Figure 2.--Agricultural Dothan series, Tift Co.: Soil water retention for specific soil horizon--Con.

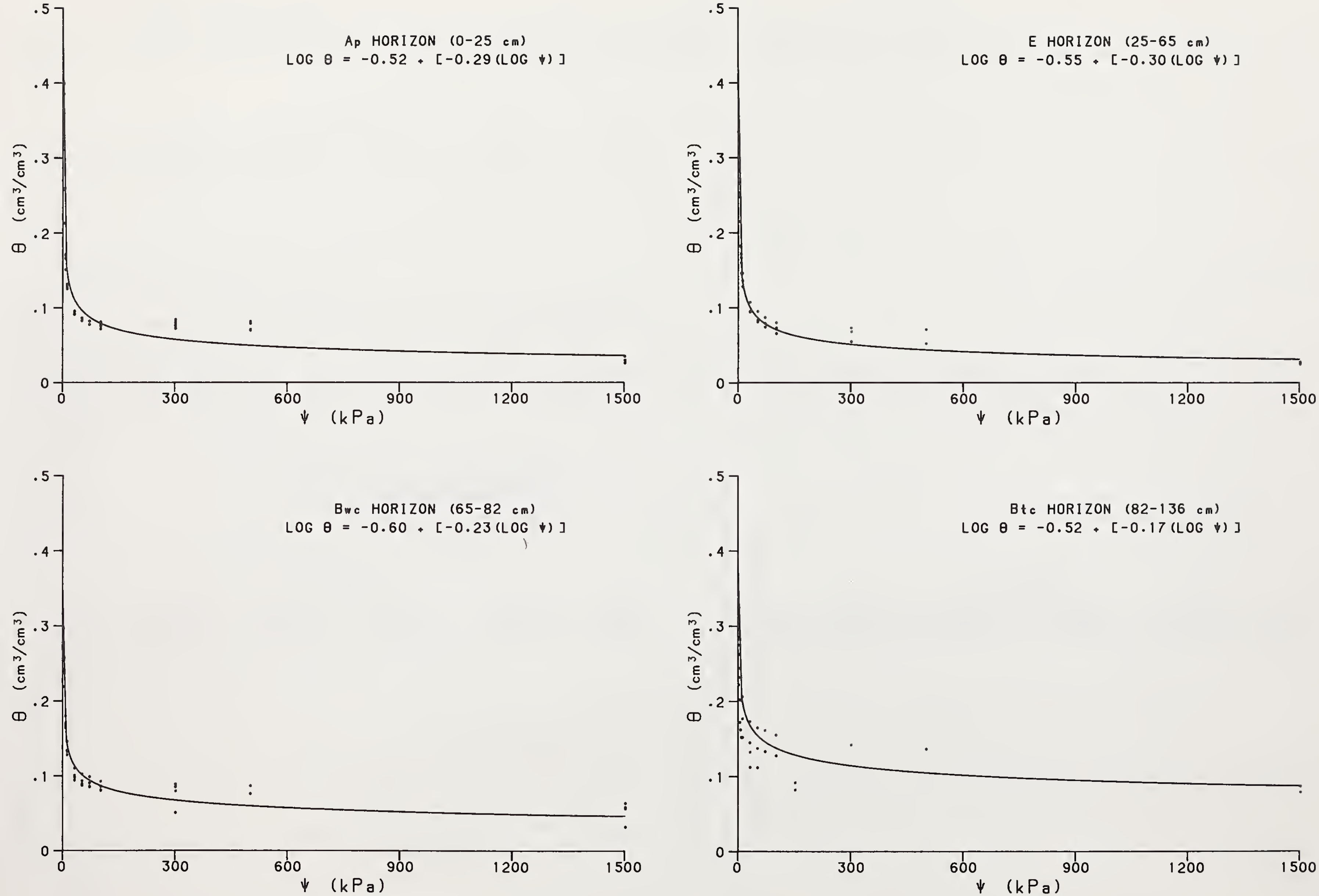


Figure 3.--Forested Fuquay series, Turner Co.: Soil water retention for specific soil horizons.

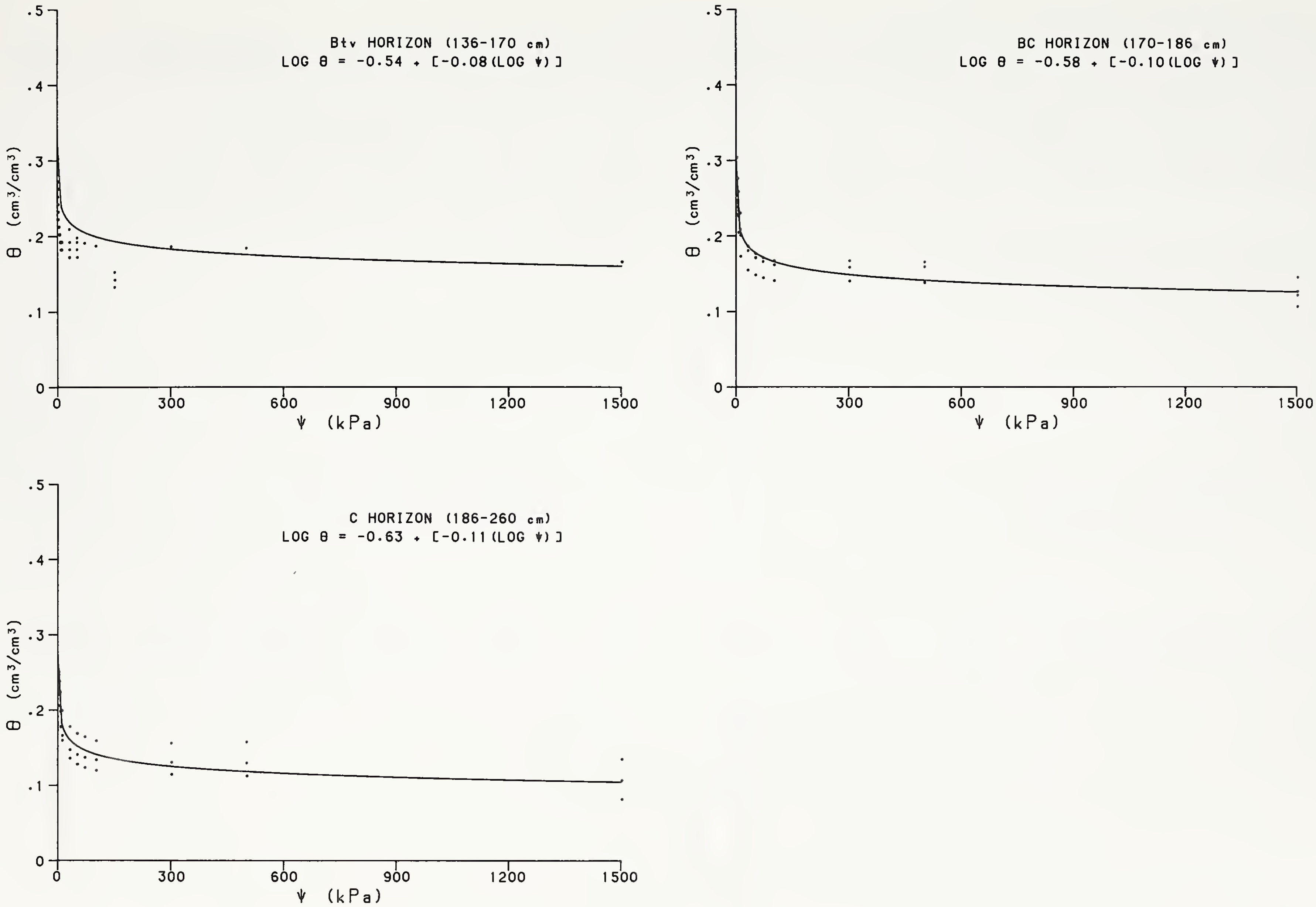


Figure 3.--Forested Fuquay series, Turner Co.: Soil water retention for specific soil horizon--Con.

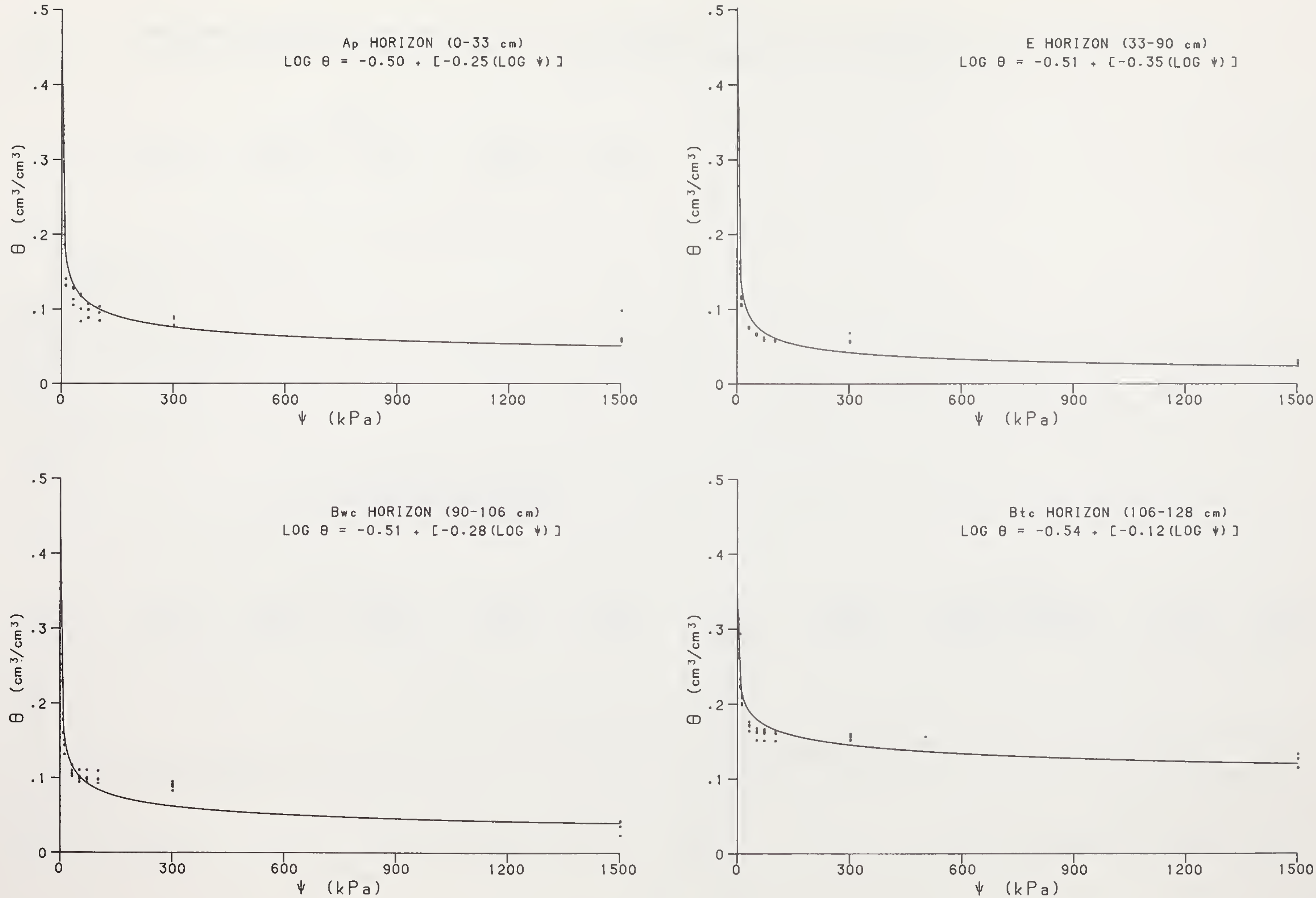


Figure 4.--Agricultural Fuquay series, Tift Co.: Soil water retention for specific soil horizons.

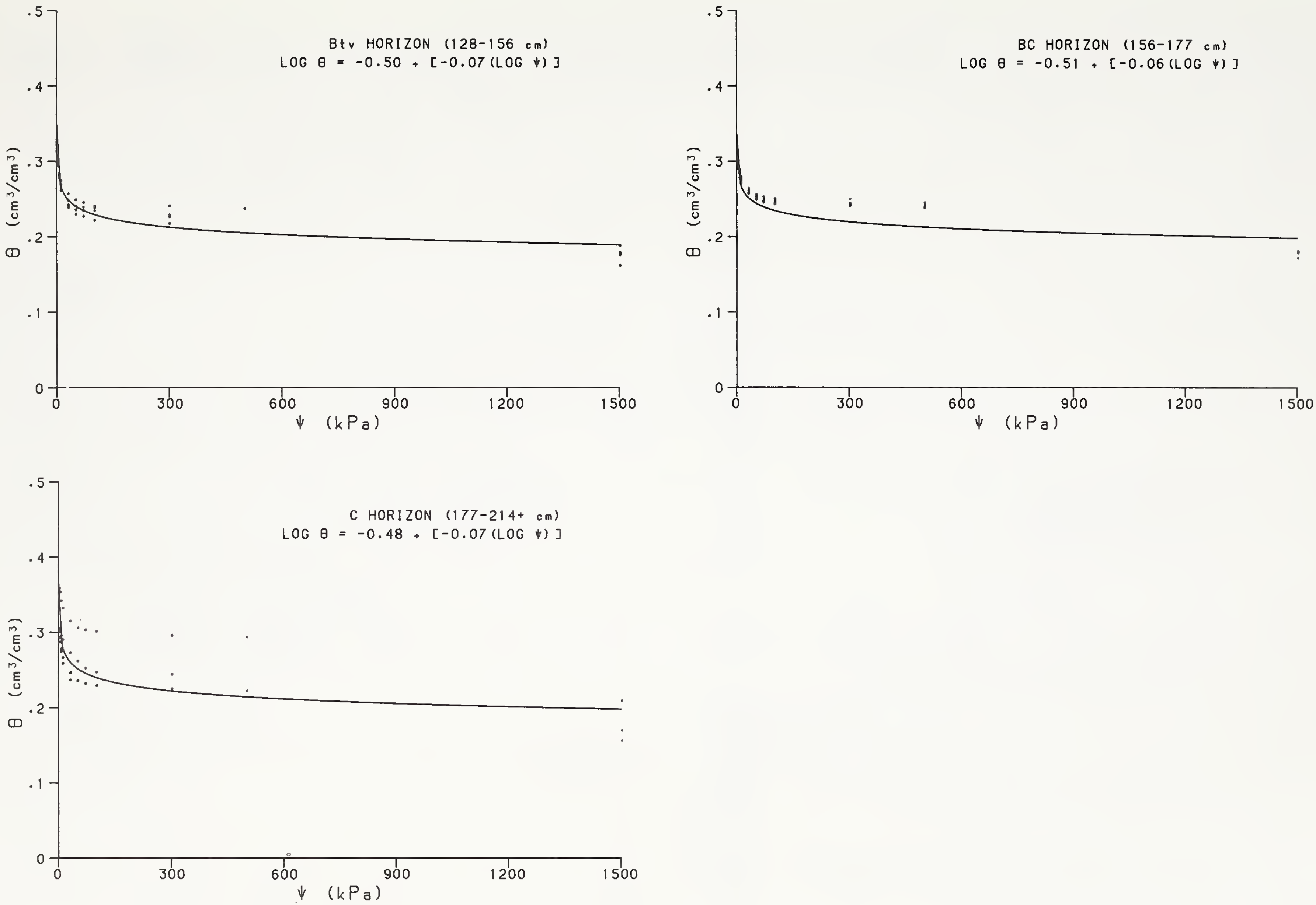


Figure 4.--Agricultural Fuquay series, Tift Co.: Soil water retention for specific soil horizon--Con.

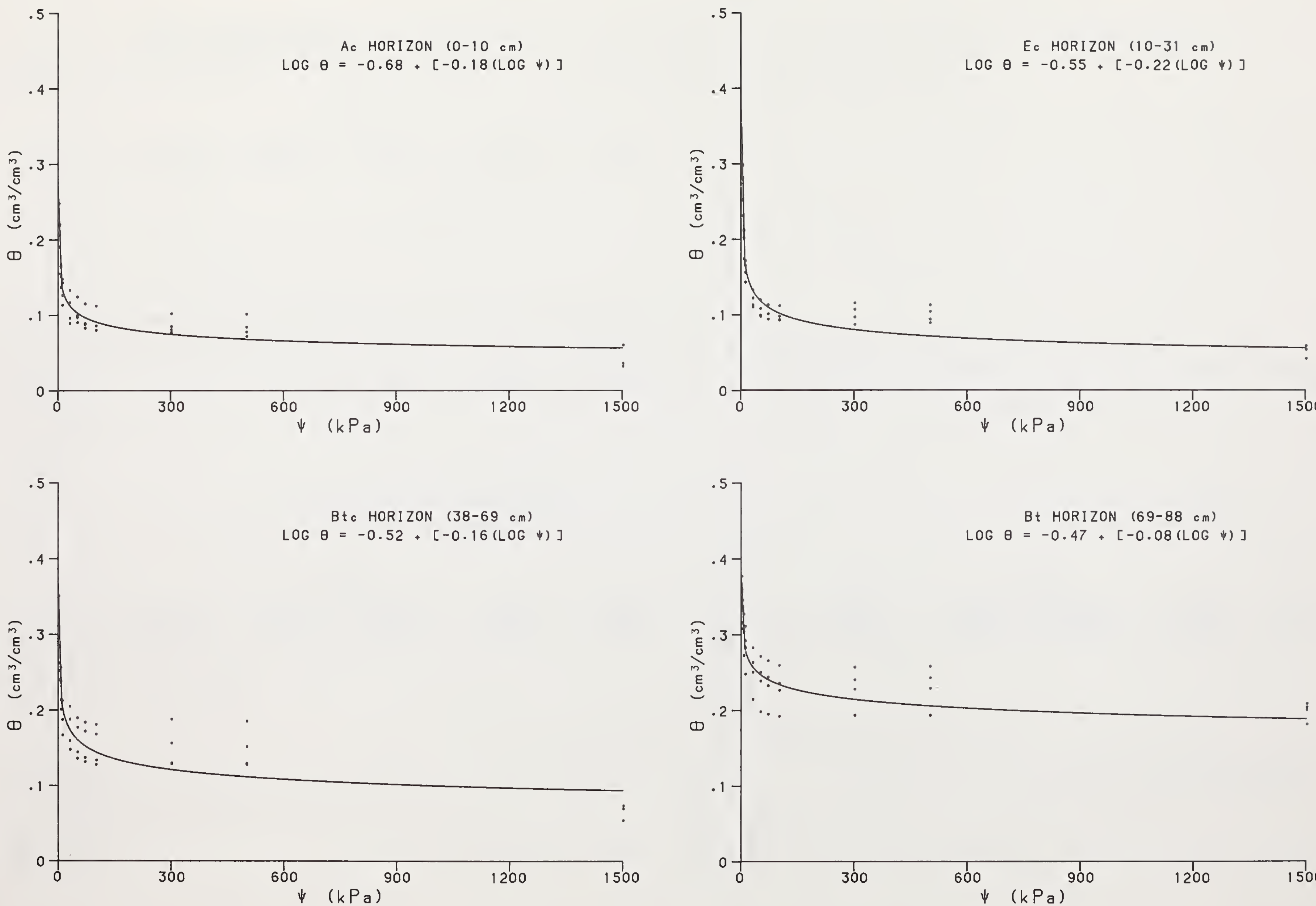


Figure 5.--Forested Tifton series, Turner Co.: Soil water retention for specific soil horizons.

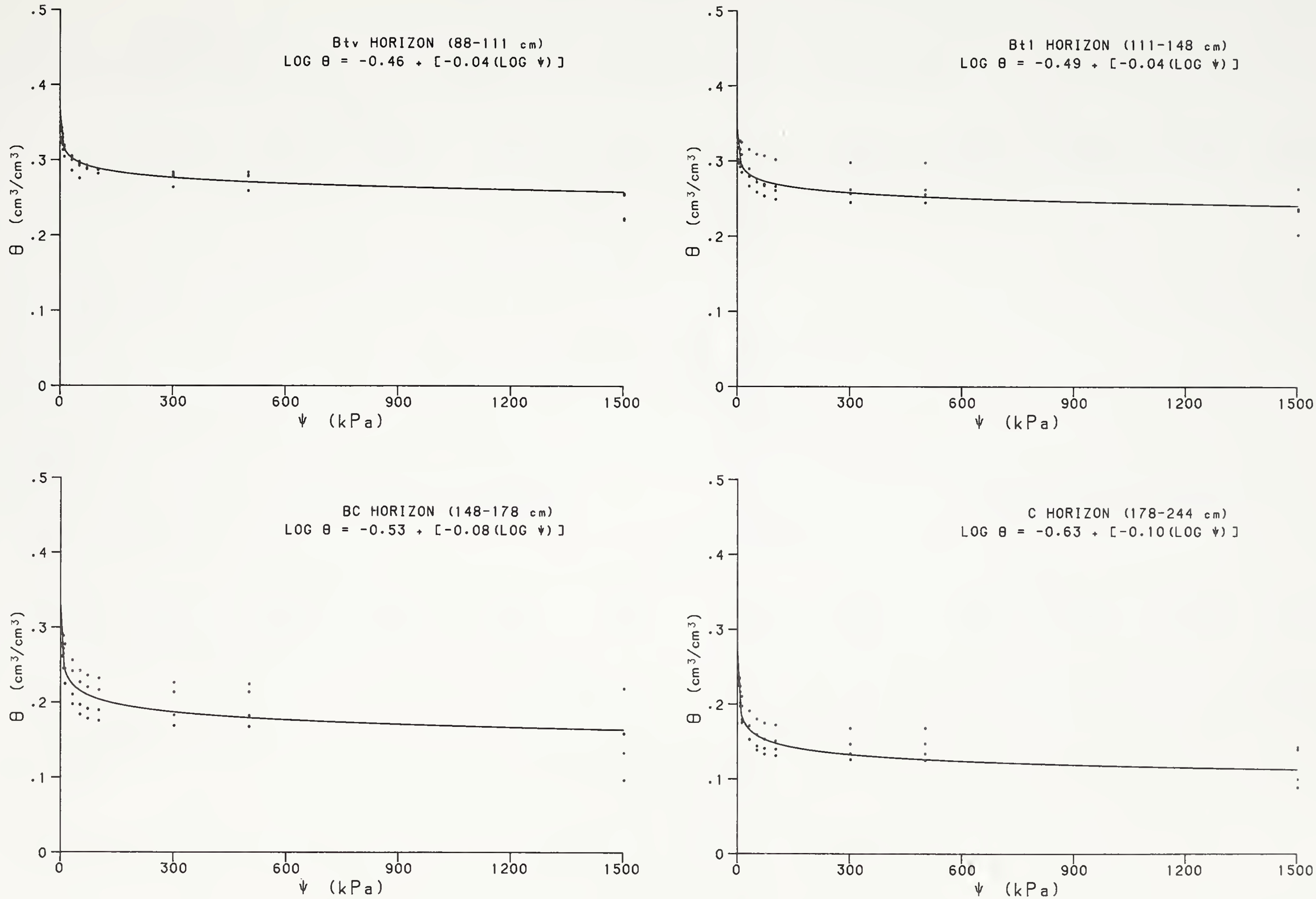


Figure 5.--Forested Tifton series, Turner Co.: Soil water retention for specific soil horizon--Con.

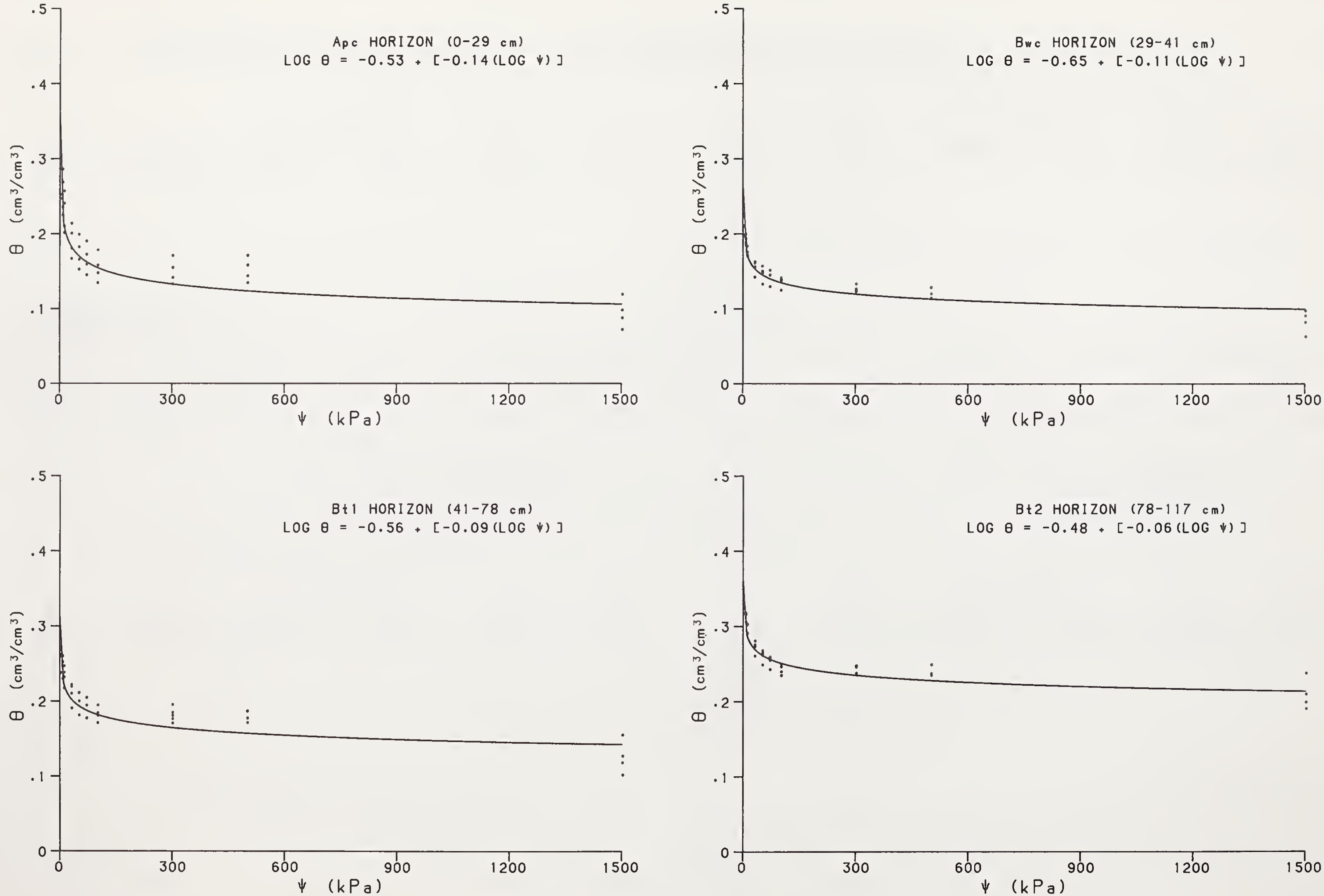
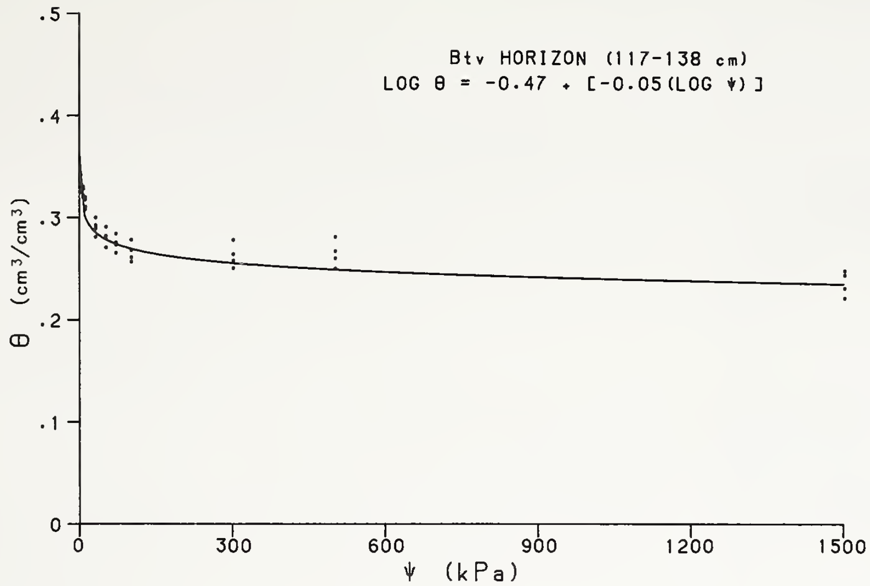
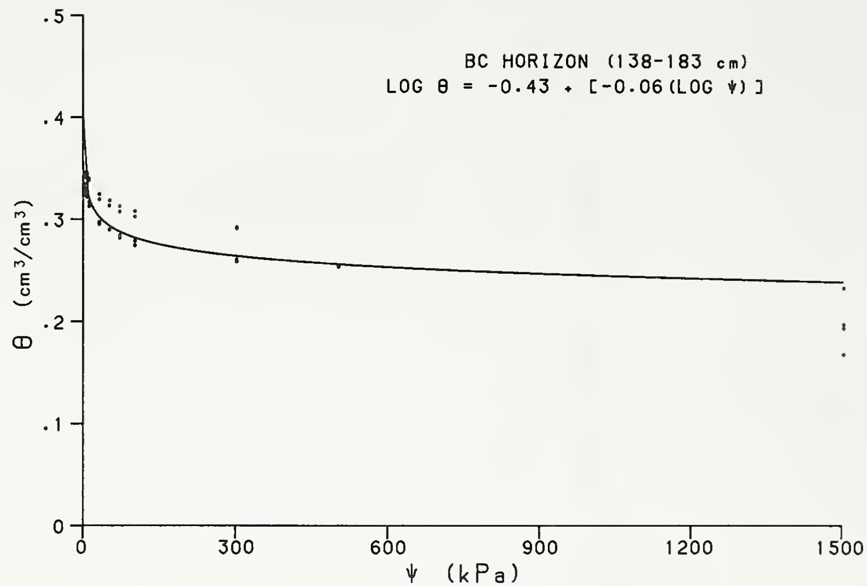


Figure 6.--Agricultural Tifton series, Tift Co.: Soil retention for specific soil horizons.





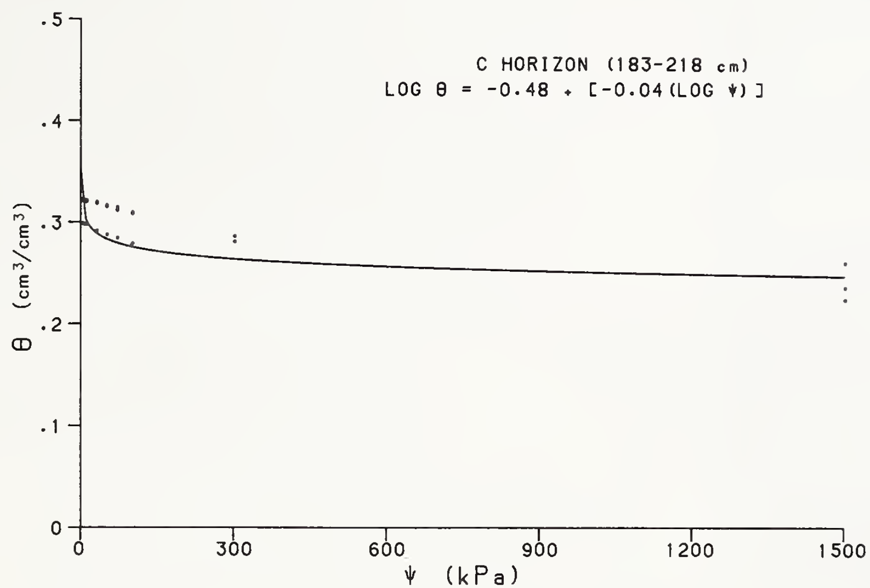


Figure 6.--Agricultural Tifton series, Tift Co.: Soil water retention for specific soil horizon--Con.

Table 29
Dothan soil series: Soil-moisture retention and saturated hydraulic conductivity

Horizon	Depth	33 kPa moisture	1500 kPa retention	Water retention difference (33 kPa-1500 kPa)	Saturated hydraulic conductivity
	(cm)	(cm^3/cm^3)	(cm^3/cm^3)	(cm^3/cm^3)	(cm/hr)
			Forested, Turner Co.		
Ap	0-20	0.13	0.05	0.08	17.13
Bw	20-38	.12	.05	.07	2.69
Bt	38-76	.18	.11	.07	1.20
Btv1	76-129	.26	.20	.06	.39
Btv2	129-160	.23	.18	.05	.18
BC	160-184	.21	.05	.06	.24
C	184-274	.18	.13	.05	.04
			Agricultural, Tift Co.		
Ap	0-30	.16	.09	.07	6.25
Bt1	30-81	.22	.15	.07	2.51
Bt2	81-104	.29	.23	.06	2.16
Btv1	104-125	.34	.29	.05	.48
Btv2	125-151	.32	.27	.05	.25
BC	151-180	.25	.19	.06	.12
C	180-211+	.28	.21	.07	.13

Table 30
Fuquay soil series: Soil-moisture retention and saturated hydraulic conductivity

Horizon	Depth	33 kPa moisture	1500 kPa retention	Water retention difference (33 kPa-1500 kPa)	Saturated hydraulic conductivity
	(cm)	(cm^3/cm^3)	(cm^3/cm^3)	(cm^3/cm^3)	(cm/hr)
			Forested, Turner Co.		
Ap	0-25	0.11	0.04	0.07	31.02
E	25-65	.10	.03	.07	5.56
Bwc	65-82	.11	.05	.06	7.03
Btc	82-136	.17	.09	.08	4.50
Btv	136-170	.21	.15	.06	.46
BC	170-186	.18	.12	.06	.66
C	186-260	.16	.10	.06	.71
			Agricultural, Tift Co.		
Ap	0-33	.13	.09	.07	10.53
E	33-90	.09	.02	.07	10.19
Bwc	90-106	.12	.04	.08	10.79
Btc	106-128	.18	.11	.07	4.85
Btv	128-156	.25	.19	.06	.96
BC	156-177	.26	.20	.05	.42
C	177-214+	.26	.20	.06	.34

Table 31
Tifton soil series: Soil-moisture retention and saturated hydraulic conductivity

Horizon	Depth	33 kPa moisture	1500 kPa retention	Water retention difference (33 kPa-1500 kPa)	Saturated hydraulic conductivity
	(cm)	(cm^3/cm^3)	(cm^3/cm^3)	(cm^3/cm^3)	(cm/hr)
			Forested, Turner Co.		
Ac	0-10	0.11	0.05	0.06	23.67
Ec	10-31	.13	.06	.07	7.92
Btc	38-69	.17	.09	.08	1.77
Bt	69-88	.26	.19	.07	1.78
Btv	88-111	.29	.25	.04	.13
B't	111-148	.28	.24	.04	.04
BC	148-178	.22	.16	.06	.17
C	178-244	.17	.12	.05	.30
			Agricultural, Tift Co.		
Apc	0-29	.18	.11	.07	.56
Bwc	29-41	.15	.10	.05	.97
Bt1	41-78	.20	.14	.06	.51
Bt2	78-117	.27	.21	.06	.85
Btv	117-138	.29	.24	.05	.24
BC	138-183	.29	.23	.06	.34
C	183-218+	.29	.25	.04	.07

Constant head was maintained using a 19-L carboy and siphon system. Mean conductivities ranged from 31 to 0.04 cm/hr. With the exception of the agricultural Tifton, conductivities were highest in the A horizons and decreased throughout the pedon. Low conductivities throughout the agricultural Tifton were indicative of compaction from farm machinery.

Conductivities of the A horizons of the forested soils were much higher than those of the A horizons of the agricultural soils. Conductivities of the upper B horizons of the agricultural soils tended to be somewhat higher than the same depths in the forested soils. This may have been due to a loosening effect on soil by grass roots as compared with forest trees (Shirmohammadi and Skaggs 1984). The very low conductivities found lower in the profile at all sites are responsible for the perched water table associated with plinthic soils.

Summary and Conclusions

The study characterized the properties of the Dothan, Fuquay, and Tifton series on the Little River Watershed through detailed analyses of samples collected from two sites for each soil series. Differences in soil textures were observed between soils of the same series, and these differences were reflected in such properties as soil moisture retention and saturated hydraulic conductivity. The surface horizons at all locations were primarily sand (range of 74-90%), with most of the sands in each soil being in the medium- and fine-size range. Coarse materials (greater than 2 mm) were found mostly in the Tifton and Fuquay soils, with the Dothan soils having 5 percent or less in any of their horizons. Sand percentages in each soil decreased with depth as clay contents increased. Percentages of silt in each soil were relatively uniform compared with the other two size fractions. Analyses of the sand fractions showed that the bulk of the sand was quartz. Analyses of fine clay revealed kaolinite to be the dominant mineral, with the largest quantities of fine clay (less than 0.2 µm) appearing in the Bt horizons.

More Ca and Mg were found in the pedons than Na or K. Amounts of each of these bases ranged from trace to 1.4 meq/100 g. The sum of these four bases did not exceed 2.1 meq/100 g in any of the horizons. Soil acidities were higher in all the agricultural soils than in the forested soils, with the range in the agricultural soils being 0.7 to 5.5 meq/100 g; while the range in acidities in the forested soils was 0.7 to 5.1 meq/100 g. The forested Tifton was much more acid than the other two forested soils. Extractable Al ranged from 0.1 to 2.8 meq/100 g and was higher in the agricultural sites than in the forested sites for the Dothan and Fuquay series, but higher in the forested site than in the agricultural site for the Tifton series. Cation exchange capacities as measured by an NH_4OAc method ranged from 0.7 to 5.3 meq/100 g without any consistent pattern of differences based on location. Values for the sum of cations (base sum plus acidity) ranged from 1.1 to 6.9 meq/100 g with differences between soils primarily reflecting differences in acidity. Bases plus Al ranged from 1.1 to 3.0 meq/100 g, with extractable Al tending to exceed the sum of bases in the lower B and C horizons. Expressions of percent Al saturation, base sum, and saturated NH_4OAc showed that both Al and H were dominating ions in these soils. Aluminum saturation generally increased with depth. The base sum percentage (percent Ca, Mg, Na, and K relative to

H) ranged from 4 to 50 percent, indicating H was the dominant ion.

Measurements of soil pH showed all the soils to be acid, with pH's ranging from 3.7-4.3, 4.2-4.9, and 4.4-5.8 for the KCl, $CaCl_2$, and H_2O methods of measurements, respectively. The agricultural soils consistently were more acid than the forested soils. Conductivities of selected horizons ranged from 0.01 to 0.18 mmhos/cm with values in each pedon being highest in the A horizon. Surface area measurements with EGME yielded ranges of 7-27 mg/g and 21-94 m^2/g, with values increasing with depth in the pedon in response to increasing clay content. Differences between sites of the same soil series also reflected differences in clay content. Organic carbon in the pedons ranged from 0.09 to 1.28 percent, with most of the OC occurring in the A horizons. Little chemical difference was observed between the soils at the forested and agricultural sites; however, surface sequences reflected management history. Total N percentages ranged from 0.11 to 0.67 percent and also were highest in the A horizons. Dithionate-citrate extractable Fe ranged from 0.2 to 4.3 percent and was highest in the Bt horizons--those horizons containing plinthite. Dithionate-citrate extractable Al ranged from 0.1 to 0.8 percent. Hydrogen fluoride dissolution for total analyses of K_2O and Fe yielded ranges of 0.2 to 0.4 percent and 3.1 to 7.0 percent, respectively.

Values for the ratio of CEC as determined by the NH_4OAc method to total percent clay ranged from 0.06-0.73. Values were highest in the A horizons. Relatively constant ratios beneath the A horizon for several of the pedons indicated that CEC was primarily a function of clay content. Ratios of 15-bar moisture retention to percent clay ranged from 0.25 to 0.46 and tended to decrease from the Ap to the E horizon, increase in the Bt and BC horizons, and decrease again in the C horizons. Values for the liquid limit ranged from 26 to 45, while plasticities ranged from nonplastic to 24. These values followed changes in clay content of the pedons.

Bulk density measurements were made on both clod and core samples collected from each site. Measurements of the clod bulk densities were made both at 1/3-bar moisture tension and when oven dry, while core bulk densities were measured only at oven-dry moisture content. Densities at each site were lowest in the A horizons, while each pedon had high densities in the BC and C horizons. Densities of the other horizons varied within the pedon. The range in 1/3-bar clod bulk densities for all six pedons was 1.32 to 2.01 g/cm^3, with the upper horizons generally having a density of about 1.6 g/cm^3, while the lower horizons had densities of 1.8-1.9 g/cm^3. The low density of 1.32 g/cm^3 occurred in the Ac horizon of the forested Tifton. Densities as measured by the oven-dry clod method were higher than those measured at 1/3-bar tension due to volume shrinkage. Higher densities were observed in the upper horizons of the agricultural soils as compared with the forested soils and presumably were related to compaction from agricultural traffic.

Densities measured by the core method on the sites were lower, with a range of 1.53 to 1.74 g/cm^3. A comparison of this observation with other comparisons of the clod and core methods of measuring bulk density confirmed that values from the core method tend to be lower. The clod method does not include the volume of space that naturally occurs between clods and,

hence, yields higher values. Calculations of the coefficient of linear extensibility (COLE) gave ranges of 0.002 to 0.020. Values were lower at the soil surface and increased with depth in response to increasing clay contents.

Soil moisture retention by the soils varied with depth in the pedon. Volumetric water contents (cm^3/cm^3) at 33 and 1500 kPa were lowest in the sandy surface horizons and increased with depth in the pedon as clay contents increased. Water retention difference, that water held between 33 and 1500 kPa, in contrast ranged from 0.04 to 0.98 for all the pedons and was in the 0.06-0.07 range for most of the horizons. Saturated hydraulic conductivities of the soils ranged from 31 to 0.04 cm/hr. Conductivities were highest in the surface horizons except for the compacted agricultural Tifton, and decreased throughout the pedon to very low conductivities in the plinthic zones. Conductivities of the A horizons of the forested soils were greater than those of the agricultural soils.

The morphological, chemical, physical, and mineralogical properties of these soils were largely dominated by soil texture. The A horizons reflected the effect of organic matter, while the E horizons reflected eluviation of fine clays. Such properties as CEC, surface area, soil moisture retention, and saturated hydraulic conductivity primarily reflected the relative proportions of sand and clay.

In general, the characteristics of Dothan, Fuquay, and Tifton soils from this study are comparable with those for the same series as reported by Carlisle et al. (1978, 1981); Fiskell and Perkins 1970; and Perkins et al. (1962, 1978, 1979). Although minor differences occurred among pedons within series, they were not great enough to result in reclassification of either series.

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Appendix.
Volumetric Water Content θ Versus Matrix
Suction Ψ by Individual Replicates

Turner County Dothan Series, Forested

Horizon	Rep.	Matric suction Ψ kPa										
		1	3	6	10	30	50	70	100	300	500	1500
		Volumetric water content θ (cm^3/cm^3)										
Ap (0-20 cm)	1	0.342	0.263	0.189	0.151	0.112	0.096	0.089	0.082	0.080	0.078	0.046
	2	.360	.278	.227	-	-	-	-	-	.094	.085	.044
	3	.358	.281	.193	.150	.110	.096	.088	.080	.077	.076	.048
	4	.388	.298	.190	.144	.104	.097	.090	.083	.079	.075	.040
Bw (20-38 cm)	1	.289	.255	.211	.142	.104	.098	.092	.086	.090	.092	.050
	2	.332	.260	.198	.160	.117	.103	.098	.090	.085	.081	.034
	3	.316	.264	.199	.160	.109	.095	.089	.083	.084	.081	.049
	4	.320	.265	.190	.151	.105	.092	.087	.081	.082	.076	.033
Bt (38-76 cm)	1	.296	.270	.242	.194	.162	.153	.146	.141	.140	.143	.134
	2	.317	.279	.236	.208	.165	.153	.147	.140	.141	.139	.097
	3	.320	.286	.252	.227	.187	.174	.168	.160	.161	.159	.112
	4	.300	.278	.236	.208	.164	.152	.146	.140	.138	.136	.096
Btv1 (76-129 cm)	1	.358	.348	.327	.305	.277	.262	.251	.247	.243	-	.210
	2	.269	.261	.247	.235	.213	.203	.200	.198	.197	.194	.160
	3	.338	.325	.315	.293	.271	.259	.252	.246	.248	.248	.198
	4	.350	.338	.323	.308	.281	.268	.262	.254	.256	.253	.219

Horizon	Rep.	Matric suction Ψ kPa 1	3	6	10	30	50	70	100	300	500	1500
		Volumetric water content θ (cm^3/cm^3)										
Btv2 (129-160 cm)	1	0.289	0.280	0.263	0.249	0.222	0.210	0.202	0.198	0.195	-	0.165
	2	.275	.274	.274	.270	.254	.247	.241	.237	.234	-	.202
	3	.284	.278	.270	.237	.211	.199	.192	.186	.186	.182	.177
BC (160-184 cm)	1	.300	.286	.271	.242	.216	.202	.195	.190	.189	.186	.144
	2	.265	.259	.249	.226	.202	.192	.185	.181	.177	.177	.161
	3	.261	.260	.254	.232	.211	.199	.194	.189	.187	.185	.132
	4	.266	.266	.261	.236	.210	.200	.193	.188	.184	.183	.136
C (184-274 cm)	1	.221	.215	.211	.197	.179	.172	.166	.162	.161	.159	.136
	2	.203	.198	.194	.168	.144	.135	.129	.125	.120	.120	.097
	3	.232	.227	.222	.217	.200	.193	.188	.182	.179	.178	.144
	4	.232	.228	.224	.215	.196	.188	.184	.178	.176	.175	.123

Tift Co. Dothan Series, Agricultural

Horizon	Rep.	Matric suction Ψ kPa 1	3	6	10	30	50	70	100	300	500	1500
		Volumetric water content θ (cm^3/cm^3)										
Ap (0-30 cm)	1	0.333	0.267	0.226	0.195	0.157	0.147	0.144	0.141	0.133	0.135	0.082
	2	.303	.240	.204	.171	–	–	–	–	–	–	.091
	3	.279	.232	.203	.180	.137	.125	.121	.117	.117	.112	.106
	4	.341	.269	.229	.199	.148	.134	.131	.126	.124	.119	.122
Bt1 (30-81 cm)	1	.321	.286	.252	.233	.202	.190	.186	.182	.186	.183	.134
	2	.319	.275	.238	.214	.174	.161	.158	.152	.159	.155	.093
	3	.358	.308	.280	.262	.230	.217	.213	.208	.210	.212	.165
	4	.352	.323	.298	.282	.253	.241	.236	.232	–	.234	.182
Bt2 (81-104 cm)	1	.368	.335	.313	.298	.271	.261	.257	.253	.252	.255	.190
	2	.370	.344	.325	.312	.290	.282	.278	.275	.271	.272	.203
	3	.357	.338	.317	.304	.282	.273	.268	.264	.265	.268	.219
	4	–	–	–	–	–	.294	.288	.281	.280	.278	.217
Btv1 (104-125 cm)	1	.375	.374	.367	.355	.342	.336	.331	.328	.324	.324	.274
	2	.408	.400	.381	.370	.349	.339	.334	.327	.324	.327	.274
	3	.395	.382	.364	.355	.336	.328	.323	.319	.321	.322	.251
	4	.421	.411	.400	.387	.372	.364	–	–	–	–	.265

Horizon	Rep.	Matric suction Ψ kPa										
		1	3	6	10	30	50	70	100	300	500	1500
		Volumetric water content θ (cm^3/cm^3)										
Btv2 (125-151 cm)	1	0.382	0.382	0.377	0.370	0.352	0.344	0.337	0.334	0.330	-	0.262
	2	.346	.340	.334	.327	.314	.306	.300	.295	.292	-	.288
	3	.362	.361	.351	.346	.334	.328	.322	.319	.316	-	.279
	4	.373	.365	.347	.332	.312	.300	.296	.292	.289	.291	.197
BC (151-180 cm)	1	.320	.313	.300	.294	.273	.259	.249	.244	.239	-	.238
	2	.319	.313	.305	.296	.274	.257	.250	.242	.242	0.244	.152
	3	.298	.295	.287	.280	.258	.245	.237	.232	.225	.226	.173
	4	.307	.296	.285	.275	.245	.229	.222	.215	.213	.217	.152
C (180-211+ cm)	1	.325	.317	.310	.305	.290	.282	.275	.271	.267	-	.195
	2	.333	.330	.325	.320	.303	.295	.289	.285	.282	-	.213
	3	.317	.309	.296	.289	.273	.264	.259	.255	.252	-	.200
	4	.370	.362	.354	.341	.295	-	-	-	-	-	.154

Horizon	Rep.	Matric suction Ψ kPa 1	3	6	10	30	50	70	100	300	500	1500
		Volumetric water content θ (cm^3/cm^3)										
Ap (0-25 cm)	1	0.396	0.257	0.165	0.129	0.093	0.084	0.080	0.074	0.082	0.080	0.028
	2	.357	.211	.149	.123	.093	.083	.080	.074	.074	.069	.024
	3	.383	.256	.169	.127	.089	.080	.075	.070	.070	.068	.028
	4	.398	.257	.163	.127	.090	.081	.080	.080	.078	.077	.034
E (25-65 cm)	1	.270	.247	.158	.126	.092	.082	.077	.071	.053	.051	.023
	2	.268	.181	.171	.144	.106	.093	.086	.078	.072	.070	.027
	3	.295	.264	.145	-	-	-	-	-	-	-	.024
	4	.251	.213	.166	.134	.093	.079	.073	.065	.067	-	-
Bwc (65-82 cm)	1	.274	.235	.162	.127	.092	.086	.083	.079	.049	-	.055
	2	.294	.256	.178	.144	.108	.100	.097	.090	.078	.075	.030
	3	.217		.166	.130	.096	.087	.083	.078	.083	.085	.062
	4	.271	.239	.168	.132	.098	.091	.088	.084	.087		.055
Btc (82-136 cm)	1	.282	.242	.200	.175	.143	.135	.131	.126	-	-	.085
	2	.323	.273	.230	.204	.171	.163	.160	.154	.140	.135	.077
	3	.303	.281	.236	.209	.172	.161	.156	.150	.111	.112	.090
	4	.317	.268	.228	.203	.171	.162	.158	.153	.138	-	.081

Horizon	Rep.	Matric suction Ψ kPa 1	3	6	10	30	50	70	100	300	500	1500
		Volumetric water content θ (cm^3/cm^3)										
Btv (136-170 cm)	1	0.302	0.284	0.268	0.239	0.216	0.206	0.199	0.194	0.193	0.193	0.157
	2	.307	.287	.271	.241	.215	.204	.198	.194	.189	.188	.134
	3	.287	.260	.254	.226	.203	.194	.184	.182	.178	.176	.149
	4	.268	.262	.246	.232	.207	.195	.189	.185	.184	.182	.164
BC (170-186 cm)	1	.242	.236	.224	.199	.178	.169	.164	.160	.156	.157	.144
	2	.253	.226	.202	.171	.152	.146	.142	.139	.138	.136	.105
	3	.262	.244	.231	.206	.184	.175	.169	.165	.165	.163	.125
	4	.302	.274	.256	.228	-	-	-	-	-	-	.120
C (186-260 cm)	1	.249	.236	.222	.197	.176	.167	.162	.157	.154	.155	.133
	2	.245	.218	.196	.164	.145	.138	.135	.131	.129	.128	.105
	3	.233	.203	.176	.158	.134	.126	.121	.117	.112	.110	.080

Tift Co. Fuquay Series, Agricultural

		Matric suction Ψ kPa										
Horizon	Rep.	1	3	6	10	30	50	70	100	300	500	1500
		Volumetric water content θ (cm^3/cm^3)										
Ap (0-33 cm)	1	0.365	0.343	0.216	0.138	0.127	0.115	0.097	0.093	0.086	-	0.057
	2	.353	.331	.184	.129	.103	.082	-	-	.087	-	.055
	3	.374	.338	.208	.138	.110	.098	.086	.083	.077	-	.096
	4	.362	.320	.197	.130	.125	.118	.104	.102	.085	-	.059
E (33-90 cm)	1	.365	.324	.160	.115	.074	.065	.060	.056	.056	-	.029
	2	.364	.290	.152	.102	.072	.063	.056	.056	.054	-	.026
	3	.342	.263	.145	.104	.073	.065	.057	.055	.066	-	.022
	4	.354	.312	.162	.112	.072	.064	.058	.057	.054	-	.029
Bwc (90-106 cm)	1	.323	.250	.183	.148	.116	.109	.108	.108	.093	-	.021
	2	.311	.228	.158	.129	.100	.093	.092	.091	.081	-	.041
	3	.307	.242	.177	.142	.104	.097	.096	.096	.087	-	.034
	4	.358	.263	.176	.142	.108	.100	.098	.097	.090	-	.041
Btc (106-128 cm)	1	.304	.259	.222	.199	.168	.160	.159	.158	.158	.154	.113
	2	.311	.271	.292	.210	.174	.166	.164	.163	.154		.124
	3	.312	.266	.231	.206	.170	.162	.161	.159	.150		.112
	4	.304	.262	.220	.197	.162	.149	.149	.148	.150		.131

Horizon	Rep.	Matric suction Ψ kPa										
		1	3	6	10	30	50	70	100	300	500	1500
		Volumetric water content θ (cm^3/cm^3)										
Btv (128-156 cm)	1	0.299	0.293	0.281	0.272	0.255	0.247	0.243	0.238	0.238	0.235	0.177
	2	.306	.297	.280	.267	.246	.238	.237	.236	.226		.187
	3	.304	.292	.276	.259	.240	.234	.232	.232	.224		.173
	4	.317	.300	.278	.262	.236	.228	.225	.219	.215		.160
BC (156-177 cm)	1	.290	.288	.276	.269	.254	.247	.244	.242	.239	.236	.179
	2	.301	.293	.282	.274	.258	.250	.248	.245	.242	.240	.178
	3	.295	.291	282	.274	.257	.249	.244	.241	.240	.237	.171
	4	.311	.298	.286	.277	.262	.254	.251	.248	.247	.243	.180
C (177-214+ cm)	1	.303	.299	.293	.288	.271	.260	.250	.245	.242	-	.168
	2	.290	.285	.272	.257	.234	-	-	-	-	-	.155
	3	.356	.352	.340	.330	.313	.304	.301	.299	.294	.292	.208
	4	.300	.290	.276	.264	.244	.234	.230	.227	.223	.220	.154

Turner Co. Tifton Series, Forested

Horizon	Rep.	Matric suction Ψ kPa 1	3	6	10	30	50	70	100	300	500	1500
		Volumetric water content θ (cm^3/cm^3)										
Ac (0-10 cm)	1	0.217	0.204	0.164	0.141	0.114	0.097	0.086	-	0.083	0.082	0.058
	2	.246	.218	.149	.124	.087	.095	.087	0.084	.079	.077	.030
	3	.188	-	.135	.112	.095	.088	.082	.078	.075	.070	.034
	4	.153	-	.163	.147	.131	.123	.114	.110	.101	.099	.058
Ec (10-31 cm)	1	.299	.280	.200	.154	.111	.098	.092	.092	.085	.088	.053
	2	.250	.229	.173	.141	.108	.097	.092	.091	.096	.092	.041
	3	.313	.296	.210	.164	.120	.107	.099	.097	.105	.102	.057
	4	.293	.278	.209	.170	.131	.118	.111	.110	.113	.111	.052
Btc (38-69 cm)	1	.260	.250	.211	.185	.157	.142	.135	.132	.128	.128	.052
	2	.297	.282	.254	-	.203	.188	.182	.178	.186	.183	-
	3	.300	.238	.199	.165	.146	.134	.130	.126	.127	.126	.072
	4	.348	.281	.236	.210	.186	.175	.170	.166	.154	.150	.067
Bt (69-88 cm)	1	.313	.306	.271	.246	.213	.196	.193	.190	.192	.192	.180
	2	.355	.344	.325	.309	.280	.269	.264	.258	.255	.257	.207
	3	.358	.330	.307	.290	.261	.248	.242	.234	.239	.241	.198
	4	.375	.335	.302	.281	.249	.237	.231	.225	.226	.227	.202

Horizon	Rep.	Matric suction Ψ kPa 1	3	6	10	30	50	70	100	300	500	1500
		Volumetric water content θ (cm^3/cm^3)										
Btv (88-111 cm)	1	0.341	0.340	0.332	0.317	0.302	0.292	0.287	0.285	0.279	0.277	0.219
	2	.325	.322	.318	.311	.297	.290	.285	.279	.276	.276	.253
	3	.340	.336	.327	.316	.303	.295	.291	.284	.281	.281	.254
	4	.327	.320	.311	.302	.284	.273			.261	.257	.222
B't (111-148 cm)	1	.315	.315	.313	.306	.287	.274	.267	.264	.260	.260	.233
	2	.299	.294	.290	.282	.264	.256	.251	.246	.243	.242	.201
	3	.296	.296	.296	.292	.277	.269	.264	.258	.254	.254	.236
	4	.325	.324	.324	.322	.313	.307	.304	.299	.296	.296	.262
BC (148-178 cm)	1	.276	.276	.263	.243	.208	.195	.189	.187	.181	.180	.095
	2	.259	.259	.243	.222	.195	.182	.176	.173	.166	.166	.132
	3	.289	.288	.286	.275	.254	.240	.234	.230	.224	.223	.218
	4	.272	.272	.269	-	.239	.225	.218	.214	.211	.212	.158
C (178-244 cm)	1	.232	.232	.222	.208	.188	.178	.173	.170	.166	.166	.141
	2	.233	.233	.214	.195	.169	.157	.151	.149	.145	.146	.138
	3	.225	.225	.195	.173	.151	.142	.138	.138	.132	.132	.087
	4	.223	.222	.199	.177	.150	.136	.131	.129	.124	.123	.098

Tift Co. Tifton Series, Agricultural

Horizon	Rep.	Matric suction Ψ kPa 1	3	6	10	30	50	70	100	300	500	1500
		Volumetric water content θ (cm^3/cm^3)										
Apc (0-29 cm)	1	0.245	-	0.233	0.208	0.178	0.164	0.157	0.146	0.140	0.142	0.086
	2	.301	-	.284	.255	.212	.197	.188	.176	.169	.169	.070
	3	.250	-	.223	.199	.165	.150	.143	.133	.131	.133	.117
	4	.285	-	.266	.238	.198	.180	.171	.156	.153	.156	.096
Bwc (29-41 cm)	1	.208	-	.192	.174	.159	.148	.144	.136	.121	.112	.089
	2	.194	-	.183	.168	.161	.155	.150	.140	.132	.126	.096
	3	.208	-	.198	.182	.154	.146	.142	.137	.124	.118	.080
	4	.196	-	.185	.169	.140	.131	.128	.123	.121	.127	.062
Bt1 (41-78 cm)	1	.258	-	.244	.230	.217	.209	.202	.183	.179	.185	.126
	2	.236	-	.228	.215	.189	.179	.176	.169	.169	.176	.153
	3	.259	-	.250	.236	.208	.198	.192	.179	.175	.170	.116
	4	.266	-	.258	.245	.220	.208	.203	.193	.188	.184	.100
Bt2 (78-117 cm)	1	.322	-	.316	.300	.279	.266	.258	.238	.245	.247	.236
	2	.315	-	.304	.289	.259	.247	.241	.233	.236	.233	.197
	3	.323	-	.314	.300	.271	.259	.252	.244	.246	.248	.208
	4	.324	-	.314	.301	.274	.262	.256	.248	.244	.236	.188

Horizon	Rep.	Matric suction Ψ kPa 1	3	6	10	30	50	70	100	300	500	1500
		Volumetric water content θ (cm^3/cm^3)										
Btv (117-138 cm)	1	0.340	-	0.328	0.316	0.290	0.280	0.273	0.266	0.262	0.265	0.229
	2	.330	-	.326	.317	.297	.288	.282	.276	.275	.278	.242
	3	.327	-	.319	.306	.279	.268	.263	.254	.255	.258	.220
	4	.323	-	.318	.308	.287	.277	.271	.259	.248	.248	.246
BC (138-183 cm)	1	.343	.343	.343	.337	.322	.316	.310	.305	.290	-	.232
	2	.340	.339	.339	.336	.317	.311	.305	.300	.289	-	.192
	3	.332	.328	.324	.315	.295	.287	.279	.272	.258	.253	.196
	4	.323	.322	.320	.310	.293	.287	.282	.276	.256	.252	.166
C (183-218 cm)	1	.296	.296	.296	.296	.289	.285	.282	.277	-	-	.222
	2	.320	.320	.319	.319	.318	.314	.312	.308	.279	-	.258
	3	.319	.319	.318	.318	.316	.312	.309	.306	.284	.282	.222
	4	-	-	-	-	-	-	-	-	-	-	.234